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Siuslaw National Forest

Upper North Fork Siuslaw River Riparian Thinning Project

Biological Assessment for Coho Salmon and Designated Critical Habitat

Siuslaw National Forest

June 2017

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Cover Photo: Riparian Thin Unit 607-703, off of Forest Service Road 5084, upper North Fork Siuslaw River

Coho Salmon

Biological Assessment

North Fork Siuslaw River Riparian Thinning Project

June 2017

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Forest Service
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Introduction

The Central Coast Ranger District on the Siuslaw National Forest (SNF) proposes riparian thinning in three young, managed conifer stands (less than 80 years old), totaling 15.4 acres, on the upper Nork Fork Siuslaw River, within Oregon Coast coho critical habitat. Consistent with the Endangered Species Act (ESA) and its implementing regulations, this Biological Assessment (BA) documents the analysis and conclusions of the Forest Service regarding the effects of implementing the North Fork Siuslaw River Thinning Project (Project) with the following project elements:

- Riparian Thinning
  - timber felling
  - yarding
  - haul
- Fuels treatments

The analysis in this BA evaluates the effects on: (1) the Oregon Coast Evolutionarily Significant Unit (ESU) of coho salmon (*Onchorhynchus kisutch*) listed by the National Marine Fisheries Service (NMFS) as threatened; (2) designated critical habitat (CH) for the ESU (Table 1); and (3) Essential Fish Habitat (EFH) as designated by the Magnusen-Stevens Fishery Conservation and Management Act. This BA is prepared in compliance with the requirements with the Forest Service Manual (FSM) 2630.3, FSM 2672.4, and Section 7 ESA regulations.

Table 1 Federally Listed Species that occur in or near the action area and ESA effects determination for the species and designated critical habitat

Common Name	Scientific Name	Jurisdiction Agency	Federal Status	Critical Habitat	ESA Effect Determination Species/CH	MSA Effect Determination
Oregon Coast ESU coho salmon	*Onchorhynchus kisutch*	NMFS	Threatened	Designated	LAA/LAA	Adverse and Beneficial Affects (ABA)

ESA Action Area Subwatersheds and Streams

Action area means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). For this consultation the action area for the Project includes the main stem of the North Fork Siuslaw River from the upstream end of the upstream-most thinning unit (unit 607703) downstream to the North Fork's confluence with McLeod Creek approximately three miles downstream of the downstream-most thinning unit (unit 607705). All waters within the upper North Fork Siuslaw Sub-watershed (HUC 171002060701) drain through the action area except for those of the McLeod Creek drainage. A total of 9,962 acres of land drains into the action area.

Due to the limited anticipated downstream effects, including long-term positive effects, of the proposed action, no downstream stream reaches or estuarine areas are included in the action area. Oregon Coast coho salmon and its designated critical habitat (73 FR 7816) occurs throughout the entire length of the action area. Essential fish habitat (EFH) for Pacific salmon includes habitat for Chinook salmon (*O. tshawytscha*) and coho salmon. The designated critical habitat for Oregon Coast coho salmon is inclusive of EFH for Pacific salmon.

The Project area is located in portions of Township 17S, Range 10W, Sections 6 and 7, Willamette Meridian, Lane County, approximately 40 miles southwest for Corvallis (Figure 1).

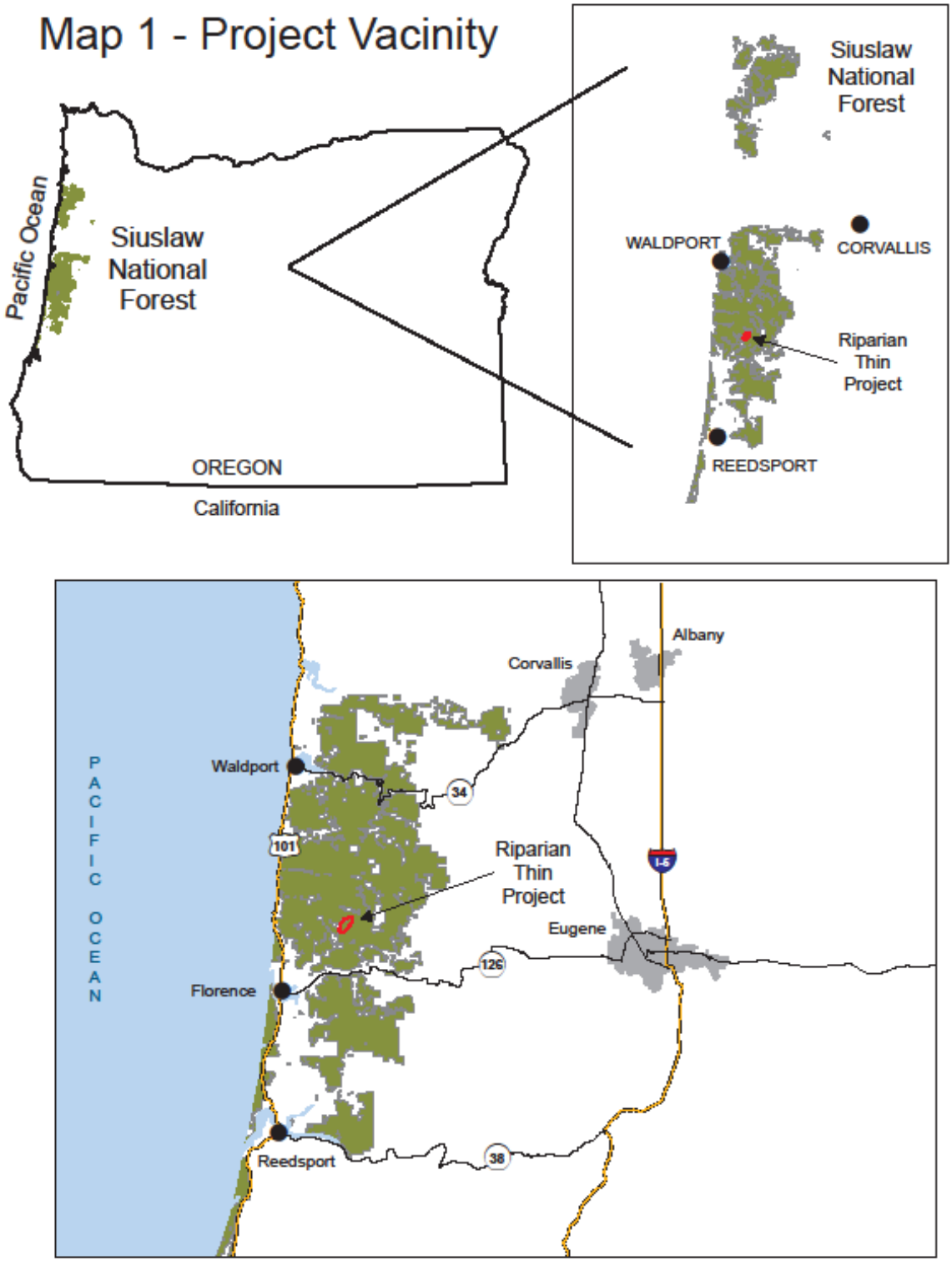

Figure 1 Vicinity map of the Project area.

Table 2 Project Area 12 Digit HUCs, Streams, River Miles, and Critical Habitat

Subwatershed (12 Digit)	12 Digit HUC	Stream	Action Area (River Mile)	Coho Critical Habitat (Miles)
Upper North Fork Siuslaw River	171002060701	Upper NF Siuslaw River	1.15	1.15
Total Miles			**1.15**	**1.15**

Consultation History

There are no past and/or ongoing informal and formal consultations that overlap the ESA action area and the 12 digit watershed of the upper North Fork Siuslaw River.

Description of the Project Area

The Project lies in the upper North Fork Siuslaw River 12 digit HUC. The upper North Fork Siuslaw River sub-watershed is a key watershed of the Northwest Forest Plan (USDA and USDI 1994). Forest Service road 5084 is the main road accessing the project area and is a paved County maintained road.

Most of the low gradient stream habitat with the highest potential for coho production occurs on private lands in both the lower and upper North Fork Siuslaw Sub-watersheds. There is a section of low gradient high value habitat in the main stem of the upper North Fork Siuslaw River on National Forest lands currently in a degraded condition; lacking the habitat complexity that in-stream large wood provides such as; deep pools, thermal cover, and associated spawning gravels. The total river frontage of these three units is approximately 0.35 miles along an approximately 1.15 mile section of the western side (river left, or road side) of the upper North Fork Siuslaw River.

Streamside vegetation in the project area lies within the wet western hemlock zone. Alder is often common in the over-story. Salmonberry and vine maple occur in the understories. Conifer tree densities in this vegetation type vary, with representative densities ranging from 54-124 trees per acre, with large trees (greater than 30 inches diameter at breast height (dbh)), accounting for only about 4 percent of this density. Forest Service lands in the sub-watershed are predominantly forested with past timber harvest having occurred on approximately 35 percent of the forested lands with the remaining 65 percent having never been harvested.

The upper North Fork Siuslaw River ranges from 30-40 feet wide through the project area and has a two-year flow return interval of 982 cubic feet per second (CFS) (USGS StreamStats version 3.0). Due to the size, the river is dependent on the presence of very large down trees for the development of key high quality fish habit that coho depend on at all life stages. These large trees function as major structural components and habitat-forming features in the floodplain and

river channel. Historic stream-side timber harvest, clear-cut harvest, intensive replanting, stream cleanout, and splash damming has impacted salmon habitat quality in the river by removing in-stream large wood and altering the riparian forests in a manner that reduced their potential to replenish future large trees to the stream.

Dense plantation stocking of conifers has slowed diameter growth within these three units, where the average dbh is 13-19 inches (Table 3). Trees that might fall into the river channel from these stands from wind throw or suppression mortality, are not large enough to be; stable, function as key large wood, or accumulate material to form significant habitat features. At current stocking levels, desired densities of trees greater than 48 inches dbh will not occur for decades. Currently, there are approximately 60 large trees per mile within 100 feet of the river on National Forest lands. However, due to past timber harvest, these trees are largely concentrated in discontinuous pockets of old growth stands, that are not occurring in the three proposed treatment units. This number of large trees per mile is twice that which occurs on private lands above and below the project area and is only about ¼ of the number of large trees per mile that would be expected to occur in continuous mature streamside stands within the project area.

Over the last 20 years the SNF has continually placed wood into the upper North Fork Siuslaw River to restore fish habitat. The current instream structures are aging and are expected to fail in the next 10 to 20 years. Typically, whole, cut trees averaging 24 to 36 dbh are placed in the stream channel. The upper diameter limit is set by the US Fish and Wildlife Service within the range of the northern spotted owl and by weight limits that can be transported by helicopter. However, rivers the size of the upper North Fork Siuslaw River need trees of this size and larger to serve as a base and key anchor pieces that persist longer and serve as functional anchors for natural accumulation of smaller, easily transported wood.

The need for near-stream sources of large diameter trees to eventually take over and provide future inputs of large wood to the channel was identified in two landscape-scale assessments: *the North Fork of the Siuslaw Watershed Analysis*, and the *Late-Successional Reserve Assessment for Oregon's Coast Province – Southern Portion*. Based on the issues identified in these and other documents, as well as initial information gathered by the ID team, the following need for the project was identified:

> There is a need to speed development of very large trees to serve as more functional anchors for salmon habitat structures. Reducing competition for light, water, and nutrients within the stand would speed development of very large trees and assist in providing more management and natural opportunities for fish habitat creation and/or improvement that would lead to recovery of full fish habitat function within this key reach, contributing to maintenance and recovery of this at-risk coho stock.

From the standpoint of restoring ecosystem function, future desirable key aquatic habitat and coho recovery, it is desirable for riparian stands to provide large wood to the river naturally. Current management of private lands for pasture and agriculture is likely to continue to limit the growth of very large trees along the stream and floodplain in the private land reaches. The best opportunity to grow and deliver very large trees and produce the highest quality habitat is within the low gradient reach on National Forest system lands.

Table 3 Stand data for the North Fork Siuslaw River Riparian Thinning Project.

Stand #	Year of Origin	Treatment Area (ac)	Tree Height (ft)	Trees per Acre		Basal Area(in^2)		QMD		Relative Density		Canopy Cover (%)	
				Pre	Post	Pre	Post	Pre	Post	Pre	Post	Pre	Post
607 705	1955	4.2	141	112	55	215	145	18.8	22	.51	.32	80	67
607 107	1963	8.6	119	151	83	269	180	18.1	20	.65	.42	87	74
607 703	1965	2.6	123	121	53	236	140	18.9	22	.56	.31	82	66
	TOTAL	**15.4**											

Proposed Action

Thinning treatments in these overly dense plantation stands would be designed to enhance the vigor and growth of large conifers in the riparian area and accelerate the onset of late-successional forest characteristics, by reducing competition and simulating natural disturbance. Treatments would significantly improve the size of future large wood available to fall in the stream, and enhance riparian hardwoods (e.g., alder, willows) that are currently suppressed by the plantation conifers.

The following prescription elements are common to all treatments. The majority of trees providing primary shade, trees larger than 19 inches dbh, and all trees providing bank stabilization, would not be felled. There will be a 30 feet no-treatment buffer and a 40 foot no-equipment buffer on all streams. Snags would be left for wildlife. Project design criteria (Appendix B) would be used to protect soil properties, future large wood, and bank stability. The three units proposed for treatment do not occur continuously along a stream but would occur in .15 to .25 mile reaches to mimic natural patterns of heterogeneity.

Project Elements

For the purposes of this analysis, the component parts of the proposed action are organized into the following Project Elements (PEs) shown below.

- Timber Felling (includes Silviculture prescriptions and yarding)
- Haul
- Fuels Treatments: piling and burning

Forest Service road 5084 is a paved county maintained road, no additional road maintenance work will be needed to complete this project. PEs will be assessed in the effects analysis section of this BA. The PEs are summarized below.

Timber Felling and Yarding

Thinning to accelerate the development of very large trees will occur in three young, managed conifer stands (plantations less than 80 years old) (units numbers: 607703, 607107, and 607705) totaling approximately 15.4 acres in size. All three stands have been harvested and replanted in the past, making even-aged plantation stands. Increases in diameter growth rates have begun to diminish. Thinning prescriptions in these stands will leave 53 to 98 trees/acre after both thinning and post-harvest treatments (e.g., snag creation, down wood) are accomplished, Table 3. Marking guides (e.g., diameter limit, radial release marking schemes) have yet to be developed. Specific Unit goals are:

- 607 705 – The prescribed treatment will be at the lower end of interquartile in order to elicit greater tree growth for future instream wood and increased large branch development for northern spotted owls and marbled murrelets.

- 607 107 – The primary purpose is to accelerate and increase tree growth, help create multiple canopy layers, maintain deep crowns, and increase understory plant diversity.
- 607 703 – The prescribed treatment will be at the lower end of interquartile in order to elicit greater tree growth for future instream wood and increased large branch development for northern spotted owls and marbled murrelets.

No thinning will occur within 30 feet of the river or any stream. There will be an equipment exclusion zone of 40 feet from the river and any stream within the project area. Harvest would include directionally felling trees away from the stream (see PDC's, Appendix B).

Post-harvest treatments for wildlife habitat include creating an average of four snags per acre from trees in the three units, and falling and leaving two trees (min 14 dbh, max 19 dbh) per acre. Cut trees, except for those left for course woody material, will be yarded to landing sites outside of the riparian areas.

Because of the flat terrain, all slopes are less than 5%, logs will be yarded using ground based systems. Designated skid trails that are approximately 15 feet wide and 150 feet apart will be used to minimize ground disturbance. Minimum buffer distance from stream edge and ground based equipment corridors will be a minimum of 40 feet. Yarding will occur in the dry season when soil moisture is low in order to minimize compaction. The predicted level of detrimental soil conditions is expected to be less than 10% of the treatment area. Because all three stands are located between the western side of the stream and road 5084, skidding will be away from the stream, towards the road. The far end of the skid trail closest to the stream, will receive the fewest number of passes by the skidder; the end closest to the road will receive the most.

Fuels Treatment (pile and burning)

Logging slash on pre-existing landings and up to 100 feet from open roads (County Road/Forest Service 5084, and the access road to the North Fork Siuslaw Campground) will be treated to reduce the potential danger of wildfire. Treatment methods include construction and burning of hand piles within 100 feet of open roads and burning any machine piles on landings. At points where a road, unit, and stream are in close proximity to each other piles could be constructed at a minimum of 40 feet from the stream (Slash is usually collected within a 10 foot radius of the pile). This distance, combined with the 30-foot no treatment area next to the stream, yields a 40-foot distance between the nearest hand pile and the stream where these set of conditions exist). Hand piles are typically 8 by 8 feet, 6 feet high and 20 feet apart. Hand piles are placed away from residual trees to prevent damage and are burned in the fall after significant rain to prevent the spread of fire.

Associated Road Activities

Log hauling would occur between August 6 and February 28. All hauling will occur on a paved County maintained road (Forest Service Road 5084) that parallels the North Fork Siuslaw River and crosses coho CH five times downstream of the project area, with the exception of one stand (607705) requiring 300 feet of gravel road hauling that provides access to the North Fork Siuslaw River Campground. No additional maintenance other than the regular bi-yearly County maintenance (brushing, pulling ditches) will be needed on the haul route to complete this project.

Timing and Duration of Activities

Felling, yarding, and hauling activities for the three stands can occur within a single operating season. Fuels treatment (hand piling/pile burning) may occur during the following operating season. General operating seasons are determined based on times of the year that are available outside of northern spotted owl and marbled murrelet nesting seasons. Project operation dates are August 6 to February 28. Yarding would be further restricted to the dry season with no yarding being permitted past October 15. Because of the paved nature of the haul route (Forest Service road 5084) timber hauling could operate from August 6 to February 28

Status Status of the Oregon Coast Coho Salmon ESU and Designated Critical Habitat

Status of the Species (Range-wide)

Over the past few decades, the sizes and distributions of the populations generally have declined due to natural phenomena and human activity, including over-harvest, hatcheries, and habitat degradation. Enlarged populations of terns, seals, sea lions, and other aquatic predators in the Pacific Northwest have been identified as factors that may be limiting the productivity of some Pacific salmon and steelhead populations (Bottom et al. 2005, Fresh et al. 2005).

Oregon Coast (OC) coho salmon includes all naturally-spawned populations of coho salmon in Oregon coastal streams south of the Columbia River and north of Cape Blanco, and progeny of five artificial propagation programs. The OC coho salmon Technical Recovery Team (OC-TRT) identified 56 historical populations and grouped them into five major "biogeographic strata" based on consideration of historical distribution, geographic isolation, dispersal rates, genetic data, life history information, population dynamics, and environmental and ecological diversity (Lawson et al. 2007).

Historical populations can be classified based on their ability to persist in isolation over time (McElhaney et al. 2000). Historical populations of OC coho salmon were separated into three categories by Lawson et al. (2007) based on their relative persistence and degree of isolation. The definitions for these three categories are as follows:

Functionally independent populations: high-persistence populations whose population dynamics or extinction risk over a 100-year time frame is not substantially altered by exchanges of individuals with other populations. These populations are net "donor" populations that may provide migrants for other types of populations.

Potentially independent populations: high-persistence populations whose population dynamics may be substantially influenced by periodic immigration from other populations. In the event of the decline or disappearance of migrants from other populations, a potentially independent population could become a functionally independent population.

Dependent populations: low-persistence populations that rely upon immigration from other populations. Without these inputs, dependent populations would have a lower likelihood of persisting over 100 years. They are "receiving" populations that are dependent on sufficient immigration from surrounding populations to persist.

Oregon Coast coho salmon residing in the action area are part of the Siuslaw functionally independent population. This population occurs within the Mid-Coast biogeographic strata of the ESU (Lawson et al. 2007).

The OC-TRT concluded that, if recent past conditions continue into the future, OC coho salmon are moderately to highly certain to persist over a 100-year period without artificial support, but have a low to moderate certainty of being able to sustain their genetic legacy and long-term adaptive potential for the foreseeable future (Wainwright et al. 2008). The weakest biogeographic strata in the OC-TRT assessment were the North Coast and Mid-Coast, which had only a low certainty of being persistent and sustainable. The major factors limiting recovery of OC coho salmon include altered stream morphology, reduced habitat complexity, loss of overwintering habitat, excessive sediment, high water temperature, and variation in ocean conditions (NMFS 2006).

Oregon Coast coho salmon adult returns have historically been quite variable by nature (Figure 1). From 1950 to 1970 adult returns were highly variable but displayed a level trend. However, beginning around 1970 and lasting until 1997 the population showed a steady decline. Then, starting in 1997 the population has shown an increasing trend in numbers of adult returns. Due to reduced harvest impacts, escapement in the years 2011 and 2014 actually exceeded the highest estimated escapements between 1950 and 1970. Based on these higher escapement levels, the population currently has a greater potential ability to pass on its genetic legacy than it did from 1950 to 1970, and a much higher potential ability than it did from 1970 to 1997. This of course assumes that the genetic legacy of the ESU was not compromised during the lean return years between 1970 and 1997.

Adult returns in some populations that make up the ESU have been great enough in recent years to allow sport harvest of this listed fish. In 2015, sport harvest was allowed for adult coho in 17 of the 21 independent populations and, when combined with estimated bycatch from other fisheries, amounted to a total of 14%, or nearly 60,500, pre-spawning adults.

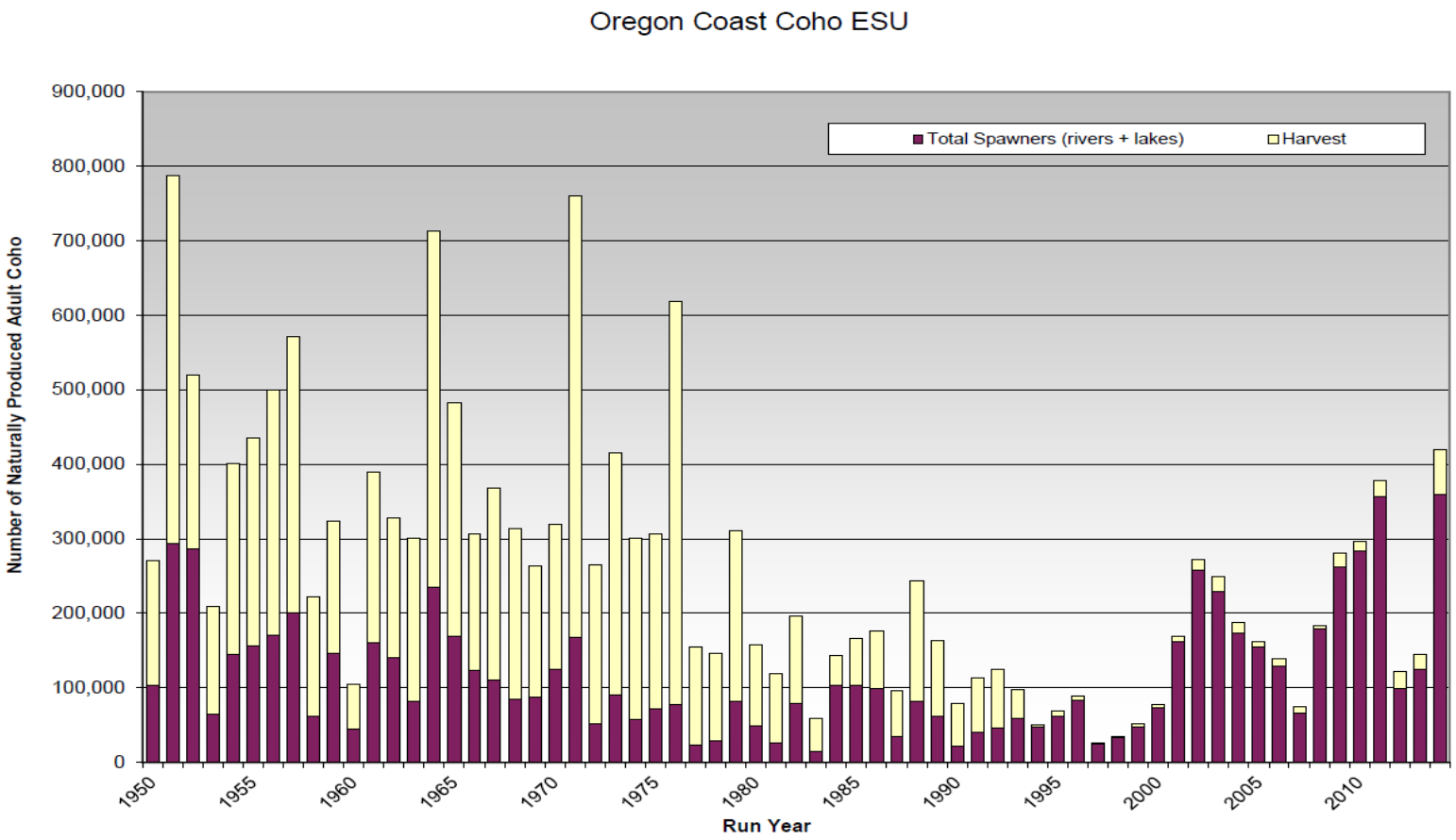

Figure 1. Estimated numbers of naturally produced adult coho in the Oregon Coast Coho ESU (run years 1950 to 2014). Number of adult coho spawning in the wild, and harvest impacts (both landed and non-landed).

Oregon Department of Fish and Wildlife, Oregon Adult Salmonid Inventory and Sampling Project

Instream habitat parameters are often influenced by upslope forest conditions including natural disturbances. Much of the genetic diversity found in salmon not only helps them adapt to local or spatial variation in habitat conditions, but also to temporal changes brought about by these natural disturbances. The historical disturbance regime of the upland forest in the central Oregon Coast Range was dominated by a mixture of high and low-severity fires, with a natural rotation of approximately 270 years. Old-growth forest coverage in the Oregon Coast Range varied from 25 to 75% during the past 3000 years, with a mean of 47%, and never fell below 5% (Wimberly et al. 2000). Currently the Coast Range has approximately 5% old-growth, almost all of it on Federal lands. The dominant disturbance now is logging on a cycle of 40 to 60 years, with fires suppressed.

The intrinsic potential of a stream to produce salmon is the production ability of a stream to produce smolts under natural conditions, where some streams are naturally better at producing smolts than others. Intrinsic potential is not dependent on the current condition of the stream or its current smolt production but rather its potential if restored to natural conditions. Relatively few landscape features can be used to determine the intrinsic potential of a stream for a given species of fish. For coho salmon, the primary features that lead to high intrinsic potential for coho smolt production are low stream gradient and high floodplain width to channel width ratio. Smaller streams are also slightly favored over larger streams.

In 2005, the Oregon Department of Fish and Wildlife (ODFW) mapped the distribution of streams with high intrinsic potential (HIP) for coho-salmon rearing by land ownership categories (ODFW 2005). Agricultural lands and private industrial forest lands are the land ownership categories with the highest percentages of HIP streams and total coho stream miles. Federal lands have only about 20% of coho stream miles and 10% of HIP stream reaches. Because of this distribution, lowland agricultural areas and private forest lands are particularly important to the conservation of OC coho.

Oregon's coho assessment concluded that at the scale of the entire species, pools are generally abundant but slow-water and off-channel habitat, which are important refugia for coho during high winter flows, are limited in most streams when compared to reference streams in minimally-disturbed areas. Amounts of large wood in streams are low in all of the four ODFW monitoring areas and for all land-use types relative to reference conditions. Amounts of fine sediment are high in three of the four monitoring areas, and were comparable to reference conditions only on public lands. Approximately 62 to 91% of tidal wetland acres (depending on estimation procedures) have been lost for all functionally and potentially independent populations of OC coho (ODFW 2005).

As part of the coastal coho assessment (ODFW 2005), the Oregon Department of Environmental Quality (ODEQ) analyzed the status and trends of water quality in the range of OC coho using

the Oregon water quality index, which is based on a combination of temperature, dissolved oxygen, biological oxygen demand, pH, total solids, nitrogen, total phosphates, and bacteria. Using the index at the species scale, 42% of monitored sites had excellent to good water quality, and 29% showed poor to very poor water quality. Within the four monitoring areas, the North Coast had the best overall conditions (6 sites in excellent or good condition out of 9 sites), and the Mid-South coast had the poorest conditions (no excellent-condition sites, and only 2 out of 8 sites in good condition). For the 10-year period monitored between 1992 and 2002, no sites showed a declining trend in water quality. The area with the most improving trends was the North Coast, where 66% of the sites (six out of nine) had a significant improvement in index scores. The Umpqua River basin, with only one out of 9 sites (11%) showing an improving trend, had the lowest number of improving sites.

The Oregon Coast Coho Conservation Plan (ODFW 2007) combined the functionally independent and potentially independent classifications of Lawson et al. (2007) into a single category called independent populations. The plan also identified limiting factors for OC coho salmon for these independent populations within the ESU (ODFW 2007). Limiting factors for dependent populations would be the same as the populations on which they were dependent.

The overall limiting factor for the independent populations within the range of OC coho salmon was stream complexity (Table 4). The plan stated that the type of habitat most limiting in the OC coho salmon ESU is high-quality over-winter rearing habitat (ODFW 2007). The plan defined high-quality over-winter rearing habitat as habitat of sufficient quality to produce over-winter survival rates high enough to allow coho spawners to replace themselves at full-seeding during periods of poor ocean conditions (3% smolt to adult survival). The plan classified habitat capable of producing 2,800 coho smolts per mile as high quality over-winter habitat. Where this habitat is lacking, high winter stream flows may flush juvenile coho out of streams into saltwater areas. If sufficient estuary habitat is not available the juveniles perish.

The definition of high-quality over-winter habitat in ODFW (2007) is based on fish production rather than habitat attributes. The primary scientific literature provides a habitat-based perspective on over-winter habitat. According to survey work done by Nickelson et al. (1992) in Oregon coastal river basins from the Nehalem River south to the Coquille River, the mean density of juvenile coho salmon in alcoves[1] and dammed pools[2], habitats with low current velocity and little turbulence during freshets, was greater than that in all other habitat types

[1] Defined as "a slack water along the channel margin separated from the main current by streambanks or 1arge channel obstructions such that it remains quiet even at high flows."
[2] Defined as "a pool impounded upstream from a complete or nearly complete channel blockage (including beaver ponds)."

sampled. The third highest density was in backwater pools, although this value was not statistically different from other habitat types[3].

Climate change is likely to adversely affect the conservation value of designated critical habitats in the Pacific Northwest. These effects are likely to include, but are not limited to, depletion of cold water habitat and other variations in quality and quantity of tributary spawning, rearing and migration habitats and estuarine areas.

Table 4 Displayed below are the primary and secondary limiting factors for independent populations in the Oregon Coast coho ESU. The action area for the Riparian Thinning Project is in the area occupied by the Siuslaw population (highlighted) (ODFW 2005).

Stratum Population	Primary Limiting Factor	Secondary Limiting factor
North Coast		
Necanicum	Stream Complexity	--
Nehalem	Stream Complexity	Water Quality
Tillamook	Stream Complexity	Water Quality
Nestucca	Stream Complexity	--
Mid Coast		
Salmon	Hatchery Impacts	Stream Complexity
Siletz	Stream Complexity	--
Yaquina	Stream Complexity	Water Quality
Beaver	Spawning Gravel	Stream Complexity
Alsea	Stream Complexity	Water Quality
Siuslaw	**Stream Complexity**	**Water Quality**
Umpqua		
Lower Umpqua	Stream Complexity	Water Quality
Middle Umpqua	Water Quantity	Stream Complexity, Water Quality
North Umpqua	Hatchery Impacts	Stream Complexity
South Umpqua	Water Quantity	Stream Complexity, Water Quality
Lakes		
Siltcoos	Exotic Fish Species	Stream Complexity, Water Quality
Tahkenitch	Exotic Fish Species	Stream Complexity, Water Quality
Tenmile	Exotic Fish Species	Stream Complexity, Water Quality
Mid-South Coast		
Coos	Stream Complexity	Water Quality
Coquille	Stream Complexity	Water Quality
Floras	Stream Complexity	Water Quality
Sixes	Stream Complexity	Water Quality

[3] Defined as "an eddy or slack water along the channel margin separated from the main current by a gravel bar or small channel obstruction."

Species within the Action Area

Specific information on the status of the species within action area, which consists of the upper North Fork Siuslaw River sub-watershed, is not available and must be inferred from information available for the Siuslaw River Population. The Siuslaw River population coho salmon is one of six identified populations in the Mid-Coast Stratum (Lawson et al. 2007). The Mid-Coast Stratum ranked moderately low in both persistence[4] and sustainability[5] with three of the six populations ranking low and the remaining three, including the Siuslaw, ranking somewhat moderate (see Wainwright et al. 2008).

Adult returns to the Siuslaw River, like the ESU as a whole, are quite variable. Since harvest was reduced following the 1993 run year, escapement (post-harvest adult returns) has averaged 15,468 fish to the subbasin with a low of 501 fish in 1997 and a high of 55,445 fish in 2002. From 1994 to 2014 coho returns to the Siuslaw River have accounted for 10.2 percent of the returns to the ESU.

Although coho salmon of the Oregon Coast ESU are currently listed as a threatened species the population is evidently considered healthy enough to support some targeted sport harvest on 17 of the 21 independent populations, including the independent Siuslaw population. Sport harvest of the Siuslaw population began in 2011 and take associated with this harvest in 2015 totaled over 1,200 adult fish. Escapement for 2015 has yet to be determined (John Spangler, ODFW district fisheries biologist, personal communication).

Critical Habitat within the Action Area

The geology of the upper North Fork Siuslaw sub-watershed is typical of much of the central Coast Range of Oregon. The parent material consists of tyee sandstone, a highly friable and easily eroded rock formation. Because of this the valley floor tends to be low gradient but somewhat narrow and the hillsides rather steep. Fish-bearing streams occur on the valley floors with the upper limit of fish distribution usually occurring where the stream dramatically steepens and ascends the headwall.

[4]A **persistent population** (or ESU) is one that is able to persist (i.e., not go extinct) over a 100-year period without artificial support. This includes an ability to survive prolonged periods of adverse environmental conditions, which may be expected to occur at least once in the 100-year time frame.

[5] A **sustainable population** (or ESU) is one that, in addition to being persistent, is also able to maintain its genetic legacy and long-term adaptive potential for the foreseeable future. This implies the availability of functional habitat and other conditions necessary for the full expression of the population's (or ESU's) life history diversity into the foreseeable future. This is similar to the definition of a self-sustaining ESU above.

The terms persistent and sustainable are both part of the more generic term "viable" as used in the viable salmonid populations report (McElhany et al. 2000). The two terms are used to distinguish distinct types and levels of risk. Persistence relates to the simple risk (or danger) of extinction, which is the primary determinant of endangered status under the ESA. Sustainability goes beyond this, requiring that population diversity (genetic and ecological) be sustained so that risk of extinction will not increase in the foreseeable future, thus relating to threatened status.

The upper North Fork Siuslaw sub-watershed was historically dominated by coniferous forest with increased amounts of hardwoods in the moister soils of the riparian areas. In 1846, the Umpqua fire burned most of the watershed leaving only about 25 percent unburned, most of which was concentrated along the main stem of the North Fork Siuslaw through and upstream of the project area. The cause of the fire is unknown but was most likely due to lightning. As is typical of the Coast Range, the new forest would have had relatively light stocking levels due to competition with brush (USDA 1994).

The upper North Fork Siuslaw sub-watershed was part of the Alsea Sub-agency of the Coast Reservation from 1855 to 1875 after which it was opened to settlement. Most of the early settlement consisted of small farms and occurred in the wide floodplains of the lower North Fork Siuslaw sub-watershed. Some settlement and associated land clearing did occur in the Action Area, most notably along the main stem of the North Fork Siuslaw River upstream and downstream of the project area. These areas have remained in private ownership (USDA 1994).

Logging began in the late 1800s. Due to poor or non-existent roads most trees were harvested near streams and logs were transported to downstream mills by the river. Three splash dams were documented by Miller (2010) as having been present in the upper North Fork Siuslaw River sub-watershed and it appears that at least one of these dams was located upstream of all but one of the proposed thinning units.

Logging began in earnest after World War II. By the time the Northwest Forest Plan went into effect approximately 35 percent of the mature and over-mature forest stands on Forest Service lands had been harvested. Timber harvest during this time period typically had little if any streams buffers and usually included stream cleanout. The combination of splash dams, stream cleanout, and lack of buffers during harvest led to stream conditions with little wood and reduced streamside source conditions.

Fish habitat restoration efforts began relatively early in the North Fork Siuslaw River. The first large wood additions consisted of single logs anchored to the bedrock with cables or rebar. These restoration efforts have progressed to clusters of three to six logs strategically placed by helicopter in most coho-bearing streams in the upper North Fork Siuslaw River sub-watershed.

Since the Northwest Forest Plan went into effect in 1994 no clearcut harvest has occurred on Forest Service lands within the Action Area. The limited amount of timber harvest that has occurred has been focused on thinning tightly stocked plantations in order to recreate the more normal lighter stocking pattern of natural stands. Timber stands harvested by clearcut methods are currently re-growing and are already providing natural or above natural amounts of shade to smaller streams.

NMFS Matrix of Pathways and Indicators

A NMFS process paper titled "Making Endangered Species Act Determinations of Effect for Individual or Grouped Actions at the Watershed Scale" (National Marine Fisheries Service 1996) is used to describe the environmental baseline for salmon. It is commonly known as the NMFS Matrix of Pathways and Indicators, hereafter referenced as the "NMFS MPI." The NMFS MPI identifies indicators to analyze for the following pathways: 1) Water quality; 2) Habitat access; 3) Habitat elements; 4) Channel condition and dynamics; 5) Flow/hydrology; and, 6) Watershed condition. The condition of each indicator is described as either "Properly Functioning" (PF), "At Risk (AR)," or "Not Properly Functioning (NPF)" based upon specific numeric or qualitative criteria. Table 5 shows the current status of the environmental baseline using the NMFS MPI for the 10 digit HUC (North Fork Siuslaw River).

The three units occur in the main stem of the upper North Fork Siuslaw River. This section of the river is low gradient and considered to be of high intrinsic potential for coho salmon. The condition of habitat indicators for streams in the action area are described below and displayed in Table 5:

Temperature – The North Fork Siuslaw River and several tributaries exceed 64 degrees during the summer rearing period. This indicator is therefore rated as *Not Properly Functioning*.

Suspended Sediment/Turbidity – The North Fork of the Siuslaw River Watershed Assessment (USDA 1994), stream survey data, and field observations reviews indicate that sand and silt, and therefore percent surface fines, may be slightly elevated from historic conditions in most streams. No quantitative data for turbidity exists. Due to past and current human activities in the Action Area it is likely that suspended sediment and turbidity are elevated above natural levels. The primary risk for sedimentation identified in the watershed assessment was the existing road system. The greatest amount of road related sediment occurs within 10 years of road construction. The Siuslaw National Forest has not constructed any new roads in the watershed in years and has been actively rehabilitating and eliminating older roads. This indicator is therefore rated as *Functioning at Risk*.

Chemical Contamination/Nutrients - The watershed is mostly forested with very little farmland or residential land that could contribute chemicals or nutrients. Streams in the Action Area are not listed Oregon Department of Environmental Quality's 303d list for water quality limited streams. This indicator is therefore rated as *Properly Functioning*.

Physical Barriers – No known barriers exist on Forest Service or private lands within the Action Area. This indicator therefore is rated as *Properly Functioning*.

Substrate Character/Embeddedness – Historic splash dams and stream cleanout depleted the main stem of the North Fork Siuslaw River of much of its bedload and exposing bedrock. More

recent large wood additions have trapped and collected considerable amounts of substrate but the streambed has yet to completely aggrade to natural or pre-splash damming levels. Because of the nature of the tyee sandstone, sand makes up a large component of this substrate. This indicator is therefore rated as *Functioning at Risk.*

Large Woody Material - Stream surveys found that the amount of large wood greater than 24 inches in diameter varied substantially for streams in the action area but nearly every stream is far below the 80 pieces per mile required to be Properly Functioning. This is primarily due to past stream cleanout and to splash damming in the main stem of the North Fork Siuslaw River. Potential future inputs of large wood are also compromised due to past timber harvest near streams and the establishment of densely stocked plantations consisting of smaller diameter trees (USDA 1994). This indicator is therefore rated as *Not Properly Functioning*.

Pool Frequency and Quality –The North Fork of the Siuslaw River Watershed Assessment (USDA 1994) and stream survey data indicate that pool frequency is below reference conditions. The lack of pools is primarily due to the lack of large wood that creates and maintains these habitats. Large wood also contributes to pool quality. Recent additions of wood to many streams should increase the number of pools present and improve the quality of existing pools. For these reasons this indicator was rated as *Functioning at Risk.*

Large Pools – Oregon Coast Coho Assessment (ODFW 2005) documents that deep pools are significantly lower than reference conditions throughout the ESU. The North Fork Siuslaw Watershed Assessment and stream surveys indicate that large pools are below reference levels. The lack of pools is primarily due to the lack of large wood that creates and maintains these habitats. Recent additions of wood to many streams should increase the number of pools present and improve the quality of existing pools. For these reasons this indicator was rated as *Functioning at Risk.*

Off-Channel Habitat – Stream surveys indicate that off channel habitat is low. Large wood serves a major role in the formation of off-channel habitat by aggrading the streambed and maintain floodplain connectivity. Historic splash dams and stream cleanout has removed much of the wood and allowed the streambed to degrade thus reducing floodplain connectivity and off-channel habitat. Recent additions of large wood to many streams within the action area should put these streams on a trajectory for increases in off-channel habitat. For these reasons this indicator was rated as *Functioning at Risk.*

Refugia – Oregon's coho assessment (ODFW 2005) found that streams with the highest intrinsic potential for coho production occur on private land, usually farmland, but that these lands also had the greatest human impacts to that habitat. The assessment also found that the least degraded coho streams occurred on federal lands but these areas also contain a disproportionately low

amount of habitat with high intrinsic potential. The upper North Fork Siuslaw River sub-watershed is predominantly in federal ownership and, as is typical of federal lands in the range of Oregon Coast coho salmon, contains a relatively small amount of high intrinsic potential coho habitat. Much of the high intrinsic potential that does exist in the North Fork Siuslaw River sub-watershed occurs in the project area. This habitat is currently in a degraded condition due to past splash damming and stream cleanout. If this habitat was restored then the upper North Fork Siuslaw River sub-watershed would constitute a small, but essentially complete, refugia in properly functioning condition. Because high intrinsic habitat is degraded the indicator is rated *Functioning at Risk.*

Wetted Width:Depth Ratio of Scour Pools – Large wood has a great influence on pool formation and pool depth. Historic reduction in instream large wood due to splash damming and stream cleanout may have reduced the average wetted width to maximum depth ratio in scour pools in the action area. Recent additions of large wood to streams in the action area have occurred and in time improve this indicator. Until then this indicator is rated *Functioning at Risk*.

Streambank Condition – Stream surveys indicate that streambanks in the forested areas of the upper North Fork Siuslaw sub-watershed are vegetatively stabilized with little active erosion. This indicator therefore is rated as *Properly Functioning*.

Floodplain Connectivity – Downcutting of the channel of the main stem of the North Fork Siuslaw River occurred following splash damming. Other streams in the action area may also have downcut due to removal of large wood during stream cleanout activities. This downcutting has partially disconnected streams in the Action Area from their floodplains. Recent additions of large wood to many streams in the sub-watershed should trap sediments and aggrade these stream channels. Because of the size and power of the main stem of the North Fork Siuslaw River additional, very large trees will be needed to aggrade the channel. For these reasons this indicator was rated as *Functioning at Risk.*

Change in Peak/Base Flows – The upper North Fork Siuslaw sub-watershed is not gaged and therefore there is no direct documentation of changes in peak or base flows. Alterations to the sub-watershed in the form increased drainage area network and loss of floodplain may be affecting peak and base flows but these indicators are discussed elsewhere. For this reason this indicator was not rated.

Increase in Drainage Network– Connectivity due to an extensive road network causes this indicator to be rated *Functioning at Risk.*

Road Density and Location – The North Fork of the Siuslaw River Watershed Assessment (USDA 1994) indicates that the upper North Fork Siuslaw River sub-watershed has a high road density and a major valley bottom road. For these reasons this indication was rated as *Not Properly Functioning*.

Disturbance History – Past timber harvest in the sub-watershed has been extensive but much regrowth has also occurred. For these reason this indicator was rated as *Functioning at Risk*.

Riparian Reserves – Past riparian timber harvest has extensively modified vegetation in riparian reserves from a forest with mixed aged classes of conifers growing in relatively open conditions to uniform-aged tree plantations growing in tightly spaced stands. For this reason this indicator was rated as *Functioning at Risk*.

Disturbance Regime – The disturbance regime of the North Fork Siuslaw River Watershed consists of a low frequency/high intensity fire regime coupled with frequent winter floods and summers with little rainfall. Although these are natural conditions for this watershed – and most of the Oregon Coast Range – the table of population and habitat indicators used in the Analytical Process (USDA et al. 2004) classifies these conditions as not properly functioning. Given that these highly variable processes are completely natural, the terminology "not properly functioning" may not be the most appropriate, however these conditions do create higher risks for fish populations, especially if those populations are isolated from the greater population.

On the other hand, species evolve and adapt in concert with the development of their environments. The same highly variable processes that create risk for coho are also responsible for producing some of the best coho habitat in the long-term. The fact that coho were once abundant in the Coast Range is indicative of a species that is adapted to this highly variable environment and the risks to coho are therefore somewhat diminished. For this reason this indicator was rated as *Functioning at Risk*.

Table cells in bold print indicate the current status of each indicator. The habitat indicators in the NMFS matrix also correspond to the Physical or Biological Features (PBFs) of designated CH for OC coho.

Table 5 Status of Environmental Baseline for the North Fork Siuslaw River Subbasin

Indicators	Properly Functioning	At Risk	Not Properly Functioning
Water Quality			
Temperature	50 – 57° F (max 7-day average)	57 – 60° F (spawning, max 7-day average)	**> 60° F (spawning, max 7-day average)**
		57 – 64° F (migration and rearing, max 7-day average)	**> 64° F (migration and rearing, max 7-day average)**

Indicators	Properly Functioning	At Risk	Not Properly Functioning
Sediment	< 12% fines (<0.85mm) in gravel	**12 – 17% fines**	> 17% fines
Chemical Contaminants or Nutrients	**Low levels of chemical contamination from agricultural, industrial, and other sources; no excess nutrients; no CWA 303d designated reaches**	Moderate levels of chemical contamination from agricultural, industrial, and other sources; some excess nutrients; one CWA 303d designated reach	High levels of chemical contamination from agricultural, industrial, and other sources; high levels of excess nutrients; more than one CWA 303d designated reach
Habitat Access			
Physical Barriers	**Any man-made barriers present in watershed allow upstream and downstream fish passage at all flows**	Any man-made barriers present in watershed do not allow upstream and/or downstream fish passage at base/low flows	Any man-made barriers present in watershed do not allow upstream and/or downstream fish passage at a range of flows
Habitat Elements			
Substrate	Dominant substrate is gravel or cobble (interstitial spaces clear), or embeddedness <20%	**Gravel and cobble is subdominant, or if dominant, embeddedness 20 – 30%**	Bedrock, sand, silt, or small gravel dominant, or if gravel and cobble dominant, embeddedness >30%
Large Woody Debris	> 80 pieces/mile (> 24 inch diameter and > 50 ft. length	Currently meets standards for Properly Functioning, but lacks potential sources from riparian areas of woody debris recruitment to maintain that standard	**Does not meet standards for Properly Functioning and lacks potential large woody debris recruitment**
Pool Frequency	Meets pool frequency standards and meets large woody debris recruitment standards for Properly Functioning habitat	**Meets pool frequency standards but large woody debris recruitment inadequate to maintain pools over time**	Does not meet pool frequency standards
Pool Quality	Pools > 1 meter deep (holding pools) with good cover and cool water; minor reduction of pool volume by fine sediment	**Few deeper pools (> 1 meter) present or inadequate cover/ temperature; moderate reduction of pool volume by fine sediment**	No deep pools (> 1 meter) and inadequate cover/temperature; major reduction of pool volume by fine sediment
Off Channel Habitat	Backwaters with cover, and low energy off-channel areas (ponds, oxbows, etc.)	**Some backwaters and high energy side channels**	Few or no backwaters; no off-channel ponds
Refugia	Habitat refugia exist and are adequately buffered (e.g., by intact riparian reserves); existing refugia are sufficient in size, number, and connectivity to maintain viable populations or subpopulations (all life stages and forms)	**Habitat refugia exists but are not adequately buffered (e.g., by intact riparian reserves); existing refugia are insufficient in size, number, and connectivity to maintain viable populations or subpopulations (all life stages and forms)**	Adequate habitat refugia do not exist

Indicators	Properly Functioning	At Risk	Not Properly Functioning
Channel Condition & Dynamics			
Width/Depth Ratio	< 10	**10 – 12**	> 12
Stream Bank Condition	**> 90% stable; i.e. on average less than 10% of banks are actively eroding**	80 - 90% stable	< 80% stable
Floodplain Connectivity	Off-channel areas are frequently hydrologically linked to main channel; overbank flows occur and maintain wetland functions, riparian vegetation, and succession	**Reduced linkage of wetland, floodplains, and river areas to main channel; overbank flows are reduced relative to historic frequency, as evidenced by moderate degradation of wetland function and riparian vegetation/succession**	Severe reduction in hydrologic connectivity between off-channel, wetland, floodplain, and riparian areas; wetland extent drastically reduced, and riparian vegetation/success altered significantly
Flow/Hydrology			
Change in Peak/Base Flows	Watershed hydrograph indicates peak flow, base flow, and flow timing characteristics comparable to an undisturbed watershed of similar size, geology, and geography	Some evidence of altered peak flow, base flow, and/or flow timing relative to an undisturbed watershed of similar size, geology, and geography	Pronounced changes in peak flow, base flow, and/or timing relative to an undisturbed watershed of similar size, geology, and geography
Increase in Drainage Network	Zero or minimum increases in drainage network density due to roads	**Moderate increases in drainage network density due to roads (e.g., 5%)**	Significant increases in drainage network density due to roads (e.g., 20 – 25%)
Watershed Condition			
Road Density & Location	< 2 mi/mi; no valley bottom roads	2 – 3 mi/mi; some valley bottom roads	**> 3 mi/mi; many valley bottom roads**
Disturbance History	< 15% ECA (entire watershed) with no concentration of disturbance in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area	**< 15% ECA (entire watershed) but disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area**	> 15% ECA (entire watershed) and disturbance concentrated in unstable or potentially unstable areas, and/or refugia, and/or riparian area; and for NWFP area
Riparian Reserves	The riparian reserve system provides adequate shade, large woody debris recruitment, and habitat protection and connectivity in all subwatersheds, and buffers or includes known refugia for sensitive aquatic species (>80% intact), and/or for grazing impacts; percent similarity of riparian vegetation to the potential natural community/ composition > 50%	**Moderate loss of connectivity or function (shade, LWD recruitment, etc.) of riparian reserve system, or incomplete protection of habitats and refugia for sensitive aquatic species (~ 70 – 80% intact), and/or for grazing impacts; percent similarity of riparian vegetation to the potential natural community/ composition 25 – 50% or better**	**Riparian reserve system is fragmented, poorly connected, or provides inadequate protection of habitats and refugia for sensitive aquatic species (< 70% intact), and/or for grazing impacts; percent similarity of riparian vegetation to the potential natural community/ composition < 25%**

Indicators	Properly Functioning	At Risk	Not Properly Functioning

Note: Bold text in table cells indicates current status of the indicator

The environmental baseline using the NMFS matrix ratings (Table 5) is based on scientific literature review and management documents. The Oregon Coast Coho Recovery Plan, North Fork Siuslaw Watershed Assessment, and the Watershed Condition Framework support the environmental baseline ratings.

Environmental Baseline

The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process (50 CFR 402.02). An environmental baseline that does not meet the biological requirements of a listed species may increase the likelihood that adverse effects of the proposed action would result in jeopardy to a listed species or in destruction or adverse modification of a designated critical habitat.

Existing Condition

Watershed Condition Framework Assessment

The following is a complimentary summary of the existing conditions in the project area subwatershed based on the 2011 results from the Watershed Condition Framework assessment. The analysis offers a basis of comparison to the national standard of a watershed analysis and shows similar results to the Matrix assessment described above. Some of the information gathered in the assessment presented above will in turn be used to update the Watershed Condition Framework assessment for these subwatersheds.

Watershed Condition Framework Assessment Process and Evaluation

The 2011 Watershed Condition Framework (WCF) is a comprehensive approach for proactively implementing integrated restoration on priority watersheds on national forests and grasslands (Figure 2). The WCF was implemented across all National Forests to improve the Forest Service approach to watershed restoration by establishing a consistent methodology for condition assessment, and targeting the implementation of integrated collections of enhancement activities on those watersheds identified as priorities for restoration (USDA, 2011).

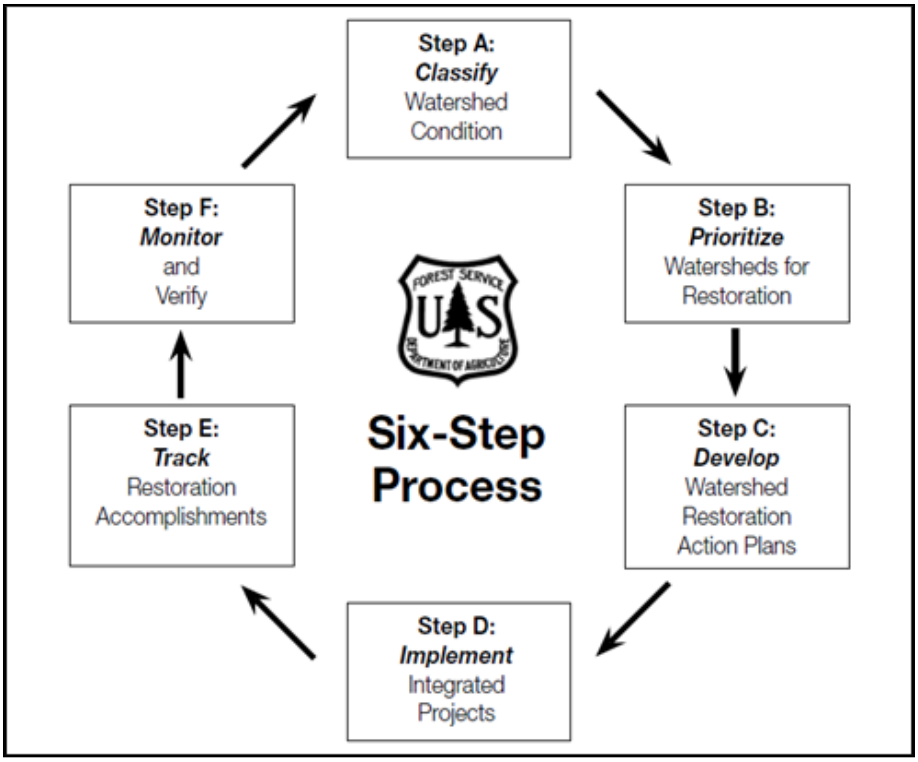

Figure 2. Six-steps of the Watershed Condition Framework process.

Six-Steps of the Watershed Condition Framework (WCF) process.
Prior to the WCF each national forest classified watershed condition (typically at the watershed, or HU5 scale) using local methods that were not consistent between forests. The WCF provides a framework for consistent assessments at the subwatershed, or HU6 scale, and for prioritizing watersheds for restoration.

Watershed condition classification is the process of describing watershed condition in terms of discrete categories (or classes) that reflect the level of watershed health or integrity. The WCF classifies watershed condition using a comprehensive set of 12 indicators that are surrogate variables representing the underlying ecological, hydrological, and geomorphic functions and processes that affect watershed condition.

The indicators are grouped according to four major process categories: (1) aquatic physical, (2) aquatic biological, (3) terrestrial physical, and (4) terrestrial biological. These categories represent terrestrial, riparian, and aquatic ecosystem processes or mechanisms by which management actions can affect the condition of watersheds and associated resources. The four "process categories" are then weighted to reflect their relative contribution toward watershed condition from a national perspective. The aquatic physical and aquatic biological categories are weighted at 30 percent each because of their direct impact to aquatic systems (endpoint indicators). The terrestrial physical category was weighted at 30 percent because roads are one of the greatest sources of impact to watershed condition. The terrestrial biological category is weighted at 10 percent because these indicators have less direct impact on watershed condition.

Primary emphasis is placed on aquatic and terrestrial processes and conditions that Forest Service management activities can influence. The approach is designed to promote integrated watershed assessments; target programs of work in watersheds that have been identified for restoration; enhance communication and coordination with external agencies and partners; and improve reporting and monitoring of program accomplishments.

Within the project area, there is only the upper North Fork Siuslaw River sub-watershed and is included in the assessment. National Forest ownership within the sub-watersheds is 88 percent. Assessment data came from the national forests so ratings apply only to the National Forest lands in the watershed. Overall watershed condition for the sub-watershed in the assessment area was rated "good" or functioning properly (see https://www.fs.fed.us/biology/watershed/condition_framework.html for details).

Five indicators most relevant to water quality and fisheries associated with this project area are; water quality, aquatic habitat, riparian/wetland vegetation, roads and trails, and fire regime and wildfire. These indicators are discussed in more detail below.

Water Quality

For water quality, the upper North Fork Siuslaw River subwatershed rated as fair condition (functioning at risk). This attribute rating is based on 303(d) status (percent of miles listed) and other known water quality impairments. A second attribute "other water quality" is based on local criteria.

Aquatic Habitat

For aquatic habitat, the upper North Fork Siuslaw River subwatershed rated in good condition (functioning properly) based on habitat quality, fragmentation and stream channel condition.

Riparian Vegetation

For the riparian vegetation indicator, the upper North Fork Siuslaw River subwatersheds rated in fair condition (functioning at risk) based on relative condition and departure from potential. As with aquatic habitat, riparian conditions also reflect legacy land uses no longer active or allowed (such as streamside clear-cutting).

Roads and Trails

Roads and trails were rated based on factors that include open road density, maintenance investment, proximity to water. The upper North Fork Siuslaw River subwatersheds rated in fair condition (functioning at risk). Road management is an ongoing agency emphasis, with national direction for transportation analysis to identify a "sustainable" (economic, social, and ecological) road system, and years of investment to reduce road impacts. Ongoing challenges include desire for public access for various purposes, needs for access for resource management and protection, and diminished funding for maintenance and storage or decommissioning of unneeded roads.

Fire Regime and Wildfire

For fire regime and wildfire, the upper North Fork Siuslaw River subwatersheds rated in fair (functioning-at-risk) condition. This attribute rating is based on the percent of the forested area

that is considered to be overstocked, meaning that conifer stands contain higher densities of trees relative to historic benchmarks, heightening the forest's susceptibility to insects and disease. Further, the higher stand densities create conditions that are highly to extremely susceptible to crown fire, where ladder fuels (multiple tree layers) exist to carry fire into tree crowns.

Watershed condition is the state of the physical and biological characteristics and processes within a watershed that affect soil and hydrologic functions supporting aquatic ecosystems. The National priority subwatersheds and regional focus watersheds have been identified on the Siuslaw National Forest utilizing the Regional Aquatic Restoration Strategy (2007) and the national Watershed Condition Framework (WCF) (USDA, FS-977, 2011). (http://www.fs.fed.us/publications/watershed/Watershed_Condition_Framework.pdf).

The 10-digit watershed scale is considered a strategic scale for analysis and long term restoration planning, whereas the 12-digit subwatershed scale is considered an operational scale for near term (3-5 year) investment in completion of essential projects. The national forests reviewed existing priorities and selected subwatersheds for near-term (3-5 year) focused investment, and identified "essential projects" to maintain or improve watershed conditions detailed in "Watershed Restoration Action Plans." Essential projects are defined as actions and treatments that are implemented as an integrated suite of on-the-ground management activities focused primarily on restoring watershed function and thereby improving watershed condition class.

Effects of the Proposed Action

The direct and indirect effects of implementing the action, including interrelated and interdependent actions, on the listed species and designated critical habitat are evaluated in this section. In addition, the probability of directly affecting juveniles, spawning adults, and incubating embryos in redds, will be assessed. The environmental impacts of implementing the project elements (PEs) will be evaluated with habitat and/or biological indicators from the NMFS Matrix to determine effects to ESA-listed OC coho and their respective designated critical habitat.

Project Elements for Analysis

For the purposes of this analysis, the component parts of the proposed action are organized into the following PEs shown below.

- Timber Felling (includes Silviculture Prescriptions and yarding)
- Fuels treatments (piling/burning).
- Road Use (includes Haul)

Project Elements Dropped from Further Analysis

An initial step in the analysis process is to determine if any of the PEs are out of proximity to impacts specific to species and or designated critical habitat. **Consequently, PEs below meet that criteria and will not be further evaluated in this BA.**

- Road Use/Haul

Direct and Indirect Effects to Designated Critical Habitat, Physical or Biological Features

The project elements (PEs) remaining (thinning and fuels treatments) will be analyzed for their effects to designated CH, and then for their effects to the species. The physical or biological features (PBFs) consist of the features identified as essential to the conservation of the listed species in the documents that designate critical habitat (50 CFR 424.12(b)). The PBFs present in the action area are displayed in Table 6. Not displayed in Table 6 are PBFs not present in the action area, which include those associated with estuarine, nearshore marine areas, and offshore marine areas.

Table 6 Physical or Biological Features (PBFs) of Oregon Coast coho critical habitat applicable to the action area

Physical or Biological Features		Species Life History Event
Site Type	**Site Attribute**	
Freshwater spawning	Substrate Water quality Water quantity	Adult spawning Embryo incubation Alevin development
Freshwater rearing	Floodplain connectivity Forage Natural cover Water quality Water quantity	Fry emergence Fry/parr growth and development
Freshwater migration	Free of artificial obstructions Natural cover Water quality Water quantity	Adult sexual maturation Adult upstream migration Fry/parr seaward migration

Physical and biological features have been determined by NMFS to be essential to the conservation of the species. The effects to each PBF, and ultimately to designated CH as a whole, can be determined by evaluating the effects to indicators of the NMFS Matrix of Pathways and Indicators that correspond to each PBF. The MNF uses a crosswalk table format for this purpose. Measurable effects to habitat indicators that correspond to specific PBFs were concluded in this analysis. The determination of effects of the project elements on the indicators is approached by looking at direct and indirect effects to the species and/or critical habitat. The analytical process considers:

Proximity – the geographic relationship between the project element of action and the species/designated critical habitat.

Probability – the likelihood that the species or habitat will be exposed to the biotic or abiotic effects of the project element or action to the indicator.

Magnitude – the severity and intensity of the effect.

Distribution – the geographic area in which the disturbance would occur (this may be several small effects or one large effect).

Frequency – how often the effect would occur

Duration – how long the effect would last. Potential categories include; short term events whose effects subside immediately (pulse effect); sustained, long-term effect, or chronic effect whose effects persist (press effect); and permanent event(s) that sets a new threshold for a species' environment (threshold effect).

Timing – when the effect would occur in relation to the species' life-history patterns.

Nature – effects of the action on elements of a species life cycle, population size or variability, or distribution; or on the physical and/or biological features of critical habitat, including direct and indirect effects.

Direct and Indirect Effects – Pool Frequency and Quality, Large Pools, Off-Channel Habitat, and Floodplain Connectivity

These indicators are grouped since they are affected similarly by PEs.

Thinning has the potential to reduce wood inputs into the upper North Fork Siuslaw River by removing the smaller suppressed trees before they die and potentially fall into the river. However, thinning has the potential to accelerate the creation of near-stream large wood that can potentially be recruited to the stream in the long-term, aggrade the channel, reconnect the floodplain, create off-channel habitat, and potentially create larger pools. For this project; yarding, and fuels treatments will not affect this indicator.

Thinning

Proximity - There will be a 30 foot no-thinning/treatment buffer, and a 40 foot no-equipment buffer from all streams.

Probability – The proposed project plans to thin up to 30 feet from the upper North Fork Siuslaw River, potentially affecting near future wood supplies by reducing the number of smaller trees recruited to the stream in the short-term, while accelerating the diameter growth rates of the residual trees. Smaller diameter trees help aggrade stream channels when trapped and retained with larger wood. However, without larger trees present in the stream (especially in the upper North Fork Siuslaw River system), smaller trees are incapable of creating large quality pools, off-channel habitats, or reconnecting the stream to its floodplain.

Magnitude – The primary purpose of the project is to accelerate the creation of large wood in the near stream environment for future large wood recruitment to the river. Large wood is expected to measurably increase the amount of sediment storage, aggrade and sort streambed materials - creating more quality pools, reconnect the floodplain to the stream, resulting in an increase of off channel habitat.

Thinning will remove less than 10 percent of smaller diameter wood recruitment along 0.35 miles of the project area. An additional 60 miles of stream (not in the treatment area) is also capable of supplying smaller diameter wood to any existing structures in the river. Large wood plays the primary role in trapping sediment, streambed aggradation, and sorting spawning gravels, smaller wood plays a secondary role. Because the amount of small wood is small compared to the potential sources and the river being wide (30-40 feet) (where in-stream small wood has little effect on pool size, quality, frequency, off channel habitat and floodplain connectivity in larger stream systems) it is unlikely thinning will have a measurable, negative effect on the formation of pools, pool frequency, quality, large pools, off-channel habitat, or floodplain connectivity.

Distribution – Future large wood inputs to the stream will occur within the three units along the upper North Fork Siuslaw River. As a result, accumulated sediment and gravels will aggrade the stream channel and potentially extend upstream beyond the units. Coupled with natural wood inputs from stands between the units, the entire reach could be affected.

Frequency – Increases in diameter growth of the residual trees would start occurring shortly after thinning and would continue for 50 to 75 years. The residual trees would be large enough to act as key pieces within 50 years. Some could be recruited to the stream by other natural causes (wind, mortality from insect) prior to that time.

Duration – Once recruitment of large wood begins its effect on restoring quality large pools, off-channel habitats, and floodplain connectivity will be sustained long-term. Future major disturbances (wildlife and wind) could also affect these indicators by alternating large wood inputs.

Timing – In the short-term any trees that are recruited to the river will be small in size, there will be no beneficial effect to these indicators. In the long-term large trees recruited to the river will restore pool frequency, quality, size, off-channel habitat, and floodplain connectivity.

Nature - Accelerated accumulations of large wood could aggrade the stream channel, sort gravels, reconnect the channel to the floodplain, create off-channel habitat, and create and maintain pool frequency, large pools, and quality. High-quality over-winter rearing habitat was identified as the most limiting habitat feature for OC coho salmon in the Siuslaw River basin (ODFW 2007). Addressing the limiting factor for coho production is the only significant mechanism to increase population size and recover the species. Other benefits of an aggraded stream channel included increased amounts of spawning gravel, stream complexity, and possibly large pool formation. Currently the depth of pools is primarily limited by the depth of depressions in the bedrock and by limits to scour pool depth in the shallow substrates. A thicker substrate layer would allow for deeper scour pools.

Element Summary - Thinning can reduce the amount of small wood recruitment in the short-term and this reduction would not be available to existing in-stream large wood structures. The amount of this reduction relative to the total amount of small, mobile wood available in the

system is quite small. Thinning will accelerate the development of large wood near the stream and its eventual recruitment to the stream. This larger wood is expected to significantly improve these indicators in the long-term. Thinning will therefore have a minimal, negative effect on the formation of pool frequency, quality, large pools, off-channel habitat, and floodplain connectivity in the short-term and a larger, beneficial effect in the long-term.

Yarding and Fuels Treatment

Proximity – There will be a 30 foot no-thinning/treatment buffer, and a 40 foot no-equipment buffer from all streams.

Probability – Removal of felled trees and burning piles on the floodplain will have no effect on these indicators. Current instream large-wood structures could aggrade the stream bed and possibly reconnect the stream to the floodplain. Yarding will remove a considerable number of felled trees from the abandoned floodplain. These felled trees could interact with streamflow to form coho habitat if the stream were reconnected with the floodplain. The current rate of aggradation is minimal and it is unlikely that the abandoned floodplain will become reconnected before the small-diameter, thinned trees have mostly decomposed. It is also highly unlikely with the current rate of aggradation that floodplain connectivity will occur during the time that pile burning residue is present.

Magnitude – Although yarding will remove a considerable amount of felled and downed trees from the abandoned floodplain, most of this wood would not naturally have been present. Conifer stands in this area naturally develop with very light stocking densities. The thinning prescription calls for leaving two downed trees per acre and creating four snags per acre for dead wood/wildlife requirements. This more closely approximates the natural amount of wood that would be present on floodplains in this vegetation type. Therefore, even with future floodplain connectivity, there would be an insignificant change to the habitat forming processes on the floodplain.

Element Summary – The chance of fuels treatment on the terrace affecting any of these indicators is highly unlikely and therefore the effect of fuels treatment in discountable. The amount of change in wood presence on the floodplain from natural levels that should be present is minor and therefore the effects from yarding are insignificant.

Indicator Summary

Fuels treatment will have an *insignificant* effect on these indicators, yarding will have a *discountable* affect, and thinning a minimal, negative effect in the short-term and a larger, beneficial effect in the long-term. Overall, the project will have a minimal, *negative* effect on the formation of large pools, off-channel habitat, and floodplain connectivity in the short-term and a larger, *beneficial* effect in the long-term.

Direct and Indirect Effects – Water Temperature/Stream Shading

Thinning and Yarding

Thinning has the potential to increase daily maximum stream temperature in the short and mid-term (1 to 30 years) by reducing stream shade. Over the long term (>30 years) increased growth in retained trees has the potential to ameliorate stream temperatures through increased hyporheic exchange after the after the production and recruitment of large wood and the associated trapping of sediments in the stream channel. Fuels treatment, and log hauling will not remove any trees or alter shade to any stream and will therefore have a *neutral effect*.

Proximity – There will be a 30 foot no-thinning buffer, and a 40 foot no-equipment buffer from all streams

Probability – Thinning has the potential to affect stream temperature by reducing shade and increasing thermal loading through solar insolation. Several studies have established the importance of shade for maintaining stream temperature (Brown 1970, 1988; Beschta *et al*. 1987; Lewis *et al*. 1999; Zwieniecki and Newton 1999). Stream shade retention correlates well with buffer width, with stream shade typically being unaffected by clearcutting when buffer widths exceed a distance equal to approximately three-quarters of the height of the adjacent stand of trees, but this relationship is quite general (Forest Ecosystem Management Team (FEMAT) 1993). The degree of shading provided by buffer widths for clearcut harvesting prescriptions is variable and buffer-strip width by itself is generally not a good predictor of shade protection (Steinblums 1977, Beschta *et al*. 1987). Studies on which the generalized three-quarters height distance is based found that the shading of streams by mature forests can be maintained by buffers ranging from as little as 30 feet (Brazier and Brown 1973) to as great as 140 feet (Steinblums *et al*.1984). Therefore the Project, with unharvested areas between the stream and the thinning unit of 30 feet, has the potential to reduce stream shade and increase stream temperature until such time shade is re-established through the combination of recovery in canopy density and an increase in tree height.

Magnitude – Most of the research related to stream temperature change and the adequacy of buffers to prevent that change was conducted on clearcut harvest scenarios, however, some work has been conducted on thinnings. One such study conducted specifically on the adequacy of buffer widths for thins in western Oregon found that light levels near streams was unaffected when using "variable width" buffers[6] similar to the no harvest areas proposed in the subject action (mean 73 feet, range 40 to 170 feet) (Chan *et al*. 2004). In addition, increases in light levels from moderate thinning (80 residual trees per acre), heavy thinning (40 residual trees per acre), and from small patch cuts (i.e., openings less than 1 acre in size adjacent to the no-cut

[6] "Variable width" buffers were based on topographic breaks and vegetation changes (Chan *et al.* 2004).

buffers) generally did not extend more than 30 to 60 feet into adjacent un-cut stands (Chan *et al.* 2004) indicating that buffers of this width generally protect stream shade from thinning. The study also found that "streamside retention" buffers[7] averaging as little as 19 feet in width (range 0-55 feet) retained streamside shade when adjacent thinning units contained 80 trees per acre. Because the proposed thinning is similar densities and has no cut areas similar to those that did not cause any increase in light levels in streams studied by Chan *et al.* (2004) it is likely that the amount of shade loss caused by the proposed thinning will be small and its effect on stream temperature will be unmeasurable and insignificant.

Groom et al. (2011) studied stream temperatures under different harvest regimes in the Coast Range of Oregon and found that timber harvest on private timber lands using Oregon Forest Practices Act guidance did not protect stream temperatures, but that harvest on State owned forest lands using more restrictive Forest Management Plan (FMP) measures did not lead to any stream temperature increases. The FMP calls for eight-meter (26 foot) no cut buffers with limited harvest the first 30 meters (96 feet) from the stream. This limited harvest zone required the maintenance of 50 trees per acre and a minimum stand density index of 25 percent. Post thinning trees per acre and stand density index prescriptions for the proposed project meet or exceed these values. Based on the Groom et al. (2011) study, the effects on stream temperature will be unmeasurable and insignificant.

Thermal loading is a major component of the energy budget of streams and can be modeled using NetMap's thermal loading tool (TerrainWorks 2016). The Forest used the NetMap thermal loading tool for the Riparian Thinning Project. The analysis included four thermal loading scenarios: 1) existing vegetation; 2) thinning with a 30-foot, no-harvest zone between the stream and the thinning area; 3) clearcut harvest with a 30-foot, no-harvest zone between the stream and the thin; and 4) bare earth (equivalent to a clearcut to the stream's edge). Although prescribed canopy cover reductions for the three thinning units ranged from 5 percent to 27 percent, all of the units were modeled conservatively with a 33 percent reduction in vegetation density for the thinning with 30-foot no-harvest zone scenario. The results of the modeling are displayed in

Table 7.

[7] "Streamside retention" buffers retained all trees with a canopy drip line influence over the stream (Chan *et al.* 2004)

Table 7 Results of the NetMap analysis on thermal loading.

	Thermal Load (Watt-Hours/m^2)				Percent Increase Relative to Bare Earth Increase (%)			
Unit #	No Treatment	Thin*	Clearcut w/buffer	Bare Earth	No Treatment	Thin*	Clearcut w/buffer	Bare Earth
607 705	793	825	909	4,225	0.0	0.8	3.4	100.0
607 107	847	880	1,001	4,376	0.0	0.8	4.4	100.0
607 703	804	838	912	4,382	0.0	0.5	3.0	100.0

* The thinning scenario is modeled with a 30-foot no harvest zone between the stream and the harvest area.

When compared to a clearcut with no buffers (bare earth) the increase in thermal loading for thinning with a 30-foot no-harvest zone next to the stream ranges from 0.6 to 0.9 percent. By comparison the increase for a clearcut with a 30-foot buffer was 2.0 to 4.4 percent, or about three to six times greater. Aspect greatly influenced the amount of increase, units with more northerly aspects (unit 703) having the least shade loss.

Past monitoring of shade by the SNF using hemispherical photography along streams near thinning units revealed little if any change. Preliminary results (report in preparation) of that monitoring show no statistically significant change in shade to the stream with some monitoring points showing a slight, one to three percent decrease in shade and other points with a slight increase in shade post-harvest (this is somewhat indicative that the changes in shade due to the thinning harvest were within the limits of detectability of this monitoring method).

The treatment of 15.4 acres of riparian plantations by thinning within the 9,962 acre catchment area that feeds water into the action area would not be expected to measurably increase stream temperatures. The retention of the 30 foot stream buffers, the small increase in thermal load anticipated from proposed thinning by NetMap modeling, the small treatment areas within 100 feet of the upper North Fork Siuslaw River that may be treated (4.6 acres spread across three units) and the retention of canopy cover above 50 percent indicate no more than very small increase in solar exposure would occur. Past research (Chan 2004 and Groom 2011) do not

indicate the project proposal is likely to increase stream temperatures. The Forest Service is the dominate ownership upstream of the project area and the large forested drainage area upstream of the treatment units would be expected to buffer potential increases in stream temperature. Combining the site specific predicted impacts, literature sources, drainage are upstream, and ownership patterns no more than immeasurable impacts to the stream channel would be anticipated at the project site.

For these reasons the project was determined to have an insignificant negative effect on stream temperature in the short-term (20-30 years) as a result of shade loss.

Improved hyporheic exchange could lead to some long-term improvement in stream temperatures. Currently, the tree diameters in the stands proposed for treatment are too small to be functional in the river. Research (Beechie et al, 2000) suggests, the minimum size trees needed to be functional in a channel the size of the NF Siuslaw (25m wide) is 60 cm (24in). Current tree diameters in the stands proposed for treatment are less than 19 inches. As identified in the Riparian Evaluation Science Reports (2013), these stands would benefit from thinning to increase recruitment of pool-forming wood. While thinning would reduce the overall volume of wood that is potentially recruited to the channel, especially in smaller size classes (<24 inches), the volume of potential wood recruitment of larger diameter pieces is increased over the long term (100 years) (Riparian Elevation 2013). The proposed thinning will increase the diameter growth rates of the residual conifer trees and will shorten the length of time needed for near-stream trees to reach the size suggested by Pollock *et al.* (2009) as being necessary to retain sediments, re-establish hyporheic exchange, and recover natural temperature regimes.

Although some large woody material has been added to the upper North Fork Siuslaw River, the life-span of this wood is currently limited along with the near-stream supply of large trees needed to naturally fall into the river as replacements. The ability to continually place large wood into the river in the future is uncertain and a near-stream, future supply of wood is needed if hyporheic exchange is to help ameliorate fluctuations in daily temperatures in the long-term.

The amount of benefit to stream temperature (reduced daily fluctuation, reduced daily highs, and increased nightly lows) from hyporheic exchange is not known.

Element Summary – With the proposed 30 buffer/no harvest zone and the residual trees that will remain in the stand it is unlikely there will be a measurable increase in stream temperature in the short-term. In the long-term, large wood recruitment is expected to trap sediment and increase the complexity of the stream allowing for improved hyporheic exchange. Increased hyporheic exchange is likely to reduce seven day average maximum temperatures but it is unknown to what extent this will occur or if the decrease would be measurable. Thinning will have an

unmeasurable and therefore *insignificant, negative* effect in the short-term and a beneficial effect in the long-term.

Fuels Treatment (Pile and Burning)

Proximity – Slash within 100 feet of the road will be hand piled, covered and burned. At points where a road, unit, and stream are in close proximity piles could be constructed as close as 40 feet from stream (30 feet due to the no harvest zone, plus 10 feet radius around the pile), however, most piles will be more than 100 feet from streams.

Probability – Burning has the potential for escape that would result in impacts to riparian timber that may provide shade to stream channels. Proposed burning would occur when background fuel moisture is high. Piles would be located on generally flat terrain, landing piles or in unit piles, with limited potential for creep. Pile burning will be done during the fall season when fuel moisture is higher than summer months. Based on the design features risk of fire escape is minimized and impacts to riparian shade would be highly unlikely.

Element Summary – Fuel treatments will have a *discountable* effect on this indicator because of the implementation of design features listed above, and the extremely unlikely probability of escape.

Indicator Summary

Thinning and fuels treatments are the only PE's affecting temperature. Fuels treatments are *discountable* to the indicator. The proposed project will have an *insignificant, negative* effect in the short-term and a beneficial effect in the long-term on the temperature indicator for thinning.

Direct and Indirect Effects – Large Woody Material

Thinning has the potential to change the distribution, size, and abundance of woody material available for future recruitment into streams. For this project; yarding, hauling, and pile and burning will not affect instream large wood, and will therefore have a *neutral* affect to this indicator. Thinning will have a short-term *negative* affect and a long-term beneficial effect to this indicator.

Thinning

Proximity – There will be a 30 foot no-thinning buffer, and a 40 foot no-equipment buffer from all streams.

Probability – Forest management activities within a distance equal to one site-potential tree height of streams have the potential to change the distribution, size, and abundance of woody material available for recruitment into streams (Ralph et al. 1994, Murphy 1995, Spence et al. 1996). Wood recruitment potential declines rapidly moving away from the stream but is highly

variable. Depending on stand age and other factors the first 100 feet of riparian forest can include 80 percent to 98 percent of the streamside large wood recruitment potential, (McDade et al. 1990, Van Sickle and Gregory 1990, Welty et al. 2002). The project plans to thin up to 30 feet from the upper North Fork Siuslaw River, reducing small trees to the stream in the short-term. However, with the silviculture prescription for the project, trees will grow faster in a shorter period of time, and larger trees can then be recruited to the stream.

Magnitude – Thinning activities will be moderate in intensity with post-thinning densities ranging from 53 to 98 trees per acre of trees averaging 13 – 19 inches dbh. Reducing the competition among trees by thinning these overstocked units will accelerate diameter growth of residual trees, and reduce out-year mortality of the remaining trees. Thinning activities will reduce the number of trees within one site-potential tree height of the river. There would be a slight reduction pre mile of pieces of wood, however, most trees would be recruited to the stream from stand suppression impacts, affecting smaller subdominant trees. The number of large woody material trees likely to be impacted by the project will be very localized and small.

The river within the project area will not be completely devoid of future inputs of wood. Some wood will be supplied from within the outer, uncut edge of the plantations, including trees along the streambank; from live trees within the thinned stands that are blown down or die overtime, from uncut stands on the opposite bank, and from natural landslides and debris flows from nearby, small tributaries.

Distribution – Small recruitable trees would be removed from the three units within the project area. Impacts due to loss of those trees would be localized to small sites in-stream adjacent to the three units where they were removed.

Frequency –Wood recruitment patterns are stochastic in nature and wood recruiting events are highly unpredictable. Predicting a wood recruitment event from natural processes is very challenging.

Duration – Thinning would most likely occur over a three month period.

Current good growth rates will be maintained further into the future for the two units that have been previously thinned and will increase in the previously unthinned stand. This reduce the time needed for the residual trees to reach the size defined as large wood by several decades. Once the trees in these stands reach the large wood size class the trees will be available to supply large wood in perpetuity. Although thinning in these stands will reduce suppression related tree mortality in the thinning units for many years, most of the trees that would have eventually died from suppression mortality would be classified as small wood.

Timing – Future instream large wood will be present and useful for coho during the fresh water portion of their life history including trapping sediments for spawning, aggrading the streambed and increasing floodplain connectivity for winter rearing, providing seasonal cover and resting and thermal pockets.

Nature – In-stream wood regulates sediment and flow routing, influences stream channel complexity and stability, increases pool volume and area, and provides hydraulic refugia and cover within streams (Bisson et al. 1987, Gregory et al. 1987, Hicks et al. 1991b, Ralph et al. 1994, Bilby and Bisson 1998). Pools created by wood provide cover, space, and cool water to rearing coho (Bjornn and Reiser 1991). Deep pools with log jams and undercut banks can provide velocity refugia for juvenile coho, preventing downstream displacement during high winter flows (Tschaplinski and Hartman 1983). Instream wood also retains salmon carcasses (Cederholm and Peterson 1985), a major source of nitrogen and carbon in stream ecosystems (Bilby et al. 1996).

Element Summary – Most of the small diameter wood generated from suppression mortality is unlikely to meet the 24-inch diameter specified for the large wood indicator (effects of the loss of small wood will be discuss in the section on Pool Frequency and Quality). Thinning the riparian stands of this small diameter wood may have very localized indirect effects to spawning and rearing habitat in the short-term. Over the long-term treatment will reduce the time needed to develop large wood. Thinning will therefore have a short-term negative effect that is not measurable, and a *beneficial* and measureable effect in the long-term. For a discussion on the effects from the loss of small, less than 24-inch in diameter wood please see the section on Pool Frequency and Quality.

Indicator Summary

The only PE affecting this indicator is thinning therefore the indicator summary (the combined element summaries) is the same as the sole element summary. The project will have a short-term *negative* effect that is not measurable and *beneficial* effect in the long-term to this indicator.

Direct and Indirect Effects – Embeddedness/Fine Sediment Suspended Sediment/Turbidity & Substrate Character/Embeddedness

These indicators are grouped since they are affected similarly by PEs.

Thinning and Yarding

Proximity – There will be a 30 foot no-thinning buffer, and a 40 foot no-equipment buffer from all streams

Probability – Thinning will accelerate diameter tree growth in the residual trees in the units, and in the long-term create larger trees within one site potential height sooner than if thinning does

not occur. These larger trees can be recruited to the stream by natural events, restoration projects or eventually through mortality. This will lead to a greater probability of debris jam formation, sediment trapping, and streambed aggradation at a more accelerated rate then if these units are left untreated.

Magnitude – One of the primary benefits of the project is to produce larger trees faster so that they can be recruited to the stream helping to restore natural instream processes such as; trapping substrates, aggrading the streambed, and adding complexity to the stream that helps sort gravel and other sediment that is beneficial to fish and other aquatic organisms. In the long term the project will have a beneficial effect to this indicator.

Element Summary – Thinning will have a *discountable* effect on the turbidity/suspended substrate indicator because no sediment is expected to be generated from or delivered to the stream. Over the long term the project will have an insignificant beneficial effect on the turbidity substrate/embeddeness indicator.

Proximity – Yarding will occur no closer than 40 feet from streams. The top ends of these trees could be as close as 40 feet from the stream and ground-based yarding equipment would have to approach this close in order to directly use grapples to capture the log during skidding. Alternately, if the log is a sufficient distance from a designated skid trail, the log can be dragged using cable and winch to the skidder.

Probability – Yarding activities can compact, expose, and displace soils. Compacted soils slow the infiltration of water leading to increased surface runoff. Exposed soils, those soils that have had their covering of duff and vegetation removed, are susceptible to displacement from runoff including displacement that delivers sediment to streams. The type and extent of soil exposure plays a role in the amount of sediment displacement, with small, patchy or discontinuous exposure yielding little displacement compared to extensive, continuous exposure. Slope also plays a critical factor in sediment delivery. Compacted surfaces that lead to stream channels may also play an important role in delivery from treatment units.

Several studies have documented the ability of undisturbed vegetative strips between harvest units and streams in reducing erosion and sediment delivery. Vegetative strips ranging in width from 40 to 100 feet appear to prevent sediment from reaching streams (Burroughs and King 1989, Corbett and Lynch 1985, Gomi et al. 2005). Lakel (2010) concluded that streamside management zones between 25 and 100 feet were effective in trapping sediment before it could enter streams.

The project will use ground-based yarding methods (skidders or forwarders) that will operate on designated skid trails to limit the extent of disturbance to soils. Ground-based equipment will

only be allowed to operate between August 6 and October 15 when soils are relatively dry to lessen the amount of compaction. Skid trails will originate next to roads and progress out through the three units at mostly right angles towards the stream. Skids trails will be relatively short due to the small size and narrow shape of the units. The short nature of the skid trails requires relatively few passes by the equipment to yard the logs to the landing. There will be a 40 foot no-equipment buffer around all streams.

The ground within the units is currently well vegetated, but some soil exposure is expected. Soil exposure will be greatest near the road-end of the skid trail where every pass of the equipment will occur and least near the stream-end of the skid trail where only one or two passes must be made. Due to the small volume of wood needing to be yarded on any one skid trail, soil exposure is expected to be patchy with less exposure at the stream-end of the skid trail and more near the road-end of the skid trail. Due to the vegetation, duff, and flat terrain of the units, little soil displacement is expected beyond a few feet from any exposed patch of soil. The 40-foot-wide unharvested and undisturbed strip of vegetation between the units and the stream is expected to capture any soil displacement that is and exception to this scenario.

Because the units are relatively flat and little ground disturbance will occur on the stream end of the skid trail and no ground skidding equipment will operate within 40 feet of the stream it is highly unlikely that sediment will be generated and transported to the upper North Fork Siuslaw River.

Element Summary – Yarding will have a ***discountable*** effect on this indicator because no sediment is expected to be delivered to the stream.

Fuels Treatment

Proximity – Slash within 100 feet of a road will be hand piled, covered, and burned. At points where a road, unit, and stream are in close proximity piles could be constructed as close as 40 feet from streams (30 feet due to the no harvest zone plus 10 feet radius around the pile) however most piles will be more than 100 feet from streams. Listed fish habitat will be at a minimum 40 feet from burn piles.

Probability – During the burning process the duff and vegetation layers under the hand piles will be consumed leaving an 8’ X 8’ area of bare earth. Because of the flat ground (<5% gradient) on which the thinning units occur it is discountable that much sediment will be mobilized. Any sediment that is mobilized will be retained by the surrounding vegetation and 30 foot no cut buffer zone. Piles on landings will be located outside the riparian areas and have no hydrologic connection to any streams.

Element Summary – Fuels treatment will have a *discountable* effect on this indicator because existing duff and vegetation is expected to trap all sediment before it can reach a stream.

Indicator Summary

Proposed thinning, yarding, and fuel treatments would have no more than *discountable* affects to the turbidity/suspended sediment indicator.

Direct and Indirect Effects – Width-to-Depth Ratio

These indicators are grouped since they are affected similarly by PEs.

Thinning has the potential to affect smaller diameter wood recruitment in the sort-term that affects this indicator. Yarding, and fuels treatment can affect this indicator through possible sedimentation.

Thinning and Yarding

Proximity – There will be a 30 foot no-thinning buffer, and a 40 foot no-equipment buffer from all streams.

Probability – Thinning is likely to reduce the recruitment of smaller wood in the short-term and reduce the length of time needed before large trees can be recruited to the stream (see large wood discussion, above). The presence of wood in streams can cause the accumulation of substrates, an increase in depth of these substrates, and scour pool formation in existing suitable substrates.

Large wood is critical for the accumulation of sediment in depth great enough to allow for deep scour to occur. The larger wood is also more stable and more capable of creating deep scour than smaller wood. Therefore thinning is likely to have a positive, beneficial effect on pool depth in the long-term. The decrease in small wood caused by thinning is unlikely to affect pool forming processes because of the amount of bedrock and lack of depth in the substrate the small wood is incapable of producing deeper pools than already exist. Thinning and the associated loss of small wood will therefore have a discountable short-term effect on pool frequency and pool depth.

Element Summary – This project element has long-term beneficial effects and discountable short-term detrimental effects the project will have a *beneficial* effect on this indicator in the long-term.

Fuels Treatment

Proximity – Fuels treatment will occur as close as 40 feet from coho CH.

Probability – Sediment can fill pools resulting in an increase in the width to depth ratio. The project will, however, have only an insignificant, short-term effect on sediment delivery (see Embeddedness/Fine Sediment/Suspended Sediment/Turbidity discussion, above). For this reason

it is highly unlikely that the project will have more than a discountable effect on pool depth and pool width to depth ratios.

Element Summary – These three project elements will have an insignificant effect on sediment delivery to streams in the Action Area which in turn will cause a discountable likelihood that pool depth will be diminished or that width to depth ratio will be altered.

Indicator Summary

Project elements affecting this indicator include thinning which will have a long-term *beneficial* effect by increasing the depth of sediments on which scour processes can act. Fuels treatment which will have a short-term *discountable* affect.

Direct and Indirect Effects - Streambank Condition

Direct disturbance to the streambanks and changes in magnitude or duration of peak flows can affect this indicator. Thinning and yarding can affect this indicator under certain conditions. Fuels treatment consisting of pile burning next to the road and 40 feet from any stream.

Thinning and Yarding

Proximity – There will be a 30 foot no-thinning buffer, and a 40 foot no-equipment buffer from all streams.

Probability – With the no-thinning buffer and no-equipment buffer it is highly unlikely that thinning and yarding will cause a direct disturbance to the streambank. These project elements also have a discountable probability of affecting peak flows (see Change in Peak/Base Flow section below) and it is therefore highly unlikely that there will be a change in streambank stability caused by a change in peak flow.

Indicator Summary

Fuels treatments were found to be *neutral* to the indicator. Project elements affecting this indicator are thinning and yarding. With the proposed no-thinning and no-equipment buffers, and due to the discountable probability of casing a change in peak flow will have a *discountable* effect on this indicator.

Direct and Indirect Effects – Chemical Contaminations/Nutrients

Thinning, yarding, and fuels treatment all involve petroleum products. Fuels treatment has the ability to release nutrients.

Thinning, Yarding, and Fuels Treatment

Proximity – Gas powered equipment will be used to fall, limb and buck trees selected for thinning. Equipment will be used within the unit boundaries within 40 feet of coho CH. No

refueling is allowed within 50 feet of any stream. Heavy equipment (yarder/skidder) and will be refueled at landings or service areas only; located at a minimum of 150 feet away from all stream channels. Fuel treatment involves the use of petroleum products to ignite hand piles that are typically more than 100 feet from streams but can be as close as 40 feet. Refueling drip torches will occur at landings or service areas, a minimum of 150 feet from streams.

Probability – The likelihood of fuel spills during refueling chainsaws, drip torches, and yarding equipment is minor and the quantities involved are small (drips and splashes). These small quantities can easily be absorbed by duff and litter and retain on site until they degrade. Fuel tanks on yarding equipment are protected and unlikely to become ruptured in anything less than a roll-over accident, an unlikely occurrence on flat terrain. Log trucks may drip some lubricants (grease and oils) on roadways with hydrological connectively to streams but the likelihood of a major fuel spill is unlikely barring a major vehicle collision. Fuel used to light piles is consumed in the burning process and will not reach listed fish habitat.

Prescribed fire can release nutrients from organic matter. Non-volatile nutrients (phosphorus and potassium) released during burning are considered to be non-mobile in soil. These nutrients are not expected to be transported to streams unless the soil particles themselves are transported. As described in the sediment/turbidity section above, soil delivery to streams is not expected and therefore phosphorus and potassium are not expected to be transported to streams. Nitrogen, another important nutrient for plant and algae growth, is highly soluble in water and easily transported by water movement. However, nitrogen is typically volatilized during burning and not present in large quantities in the soil after burning.

Fire can affect pH in soils, and the ash, if directly transported to streams, can affect the pH of the water and the aquatic life living in the water. Wildfires, especially those the burn hot in the riparian areas and are followed by heavy rains, have been known to affect aquatic life through the rapid influx of ash and soil to streams. Pile burning produces hot burns but in small isolated patches. As described in the sediment and turbidity section above, it is unlikely that any soil or ash will be transported to any stream.

Element Summary – It is highly unlikely that thinning, yarding, log hauling, and fuels treatment will affect one nutrient and chemical contaminant indicators. The effects of PE's on the chemical contamination/nutrients indicator is considered to be *discountable*.

Indicator Summary

Thinning, yarding, and fuels treatments will have a *discountable* affect to this indicator. The effects of the project on channel contaminant/nutrients indicator are *discountable*.

Direct and Indirect Effects – Physical Barriers

Proximity - None of the project elements of the project have a causal mechanism to add or remove physical barriers to coho salmon instream movements.

Indicator Summary

There is no causal mechanism the project will have *neutral* effect on this indicator.

Direct and Indirect Effects – Change in Peak/Base Flows

Thinning to reduce stand densities and enhance the growth of larger conifers in the riparian area has the potential to impact peak and base flows in the short term but would be considered *insignificant* and *discountable* and thus not meaningfully measurable to the above indicator.

Thinning and Yarding

Proximity – There will be a 30 foot no-thinning buffer, and a 40 foot no-equipment buffer from all streams.

Probability – Reducing tree densities has the potential to increase base and peak flows if a large enough proportion of the trees in a watershed are cut. Increased peak flows can lead to adjustment in channel dimensions through erosional processes that in turn can increase suspended sediment and turbidity. The treatment of 15.4 acres of plantations by thinning in the 9,962 acre catchment area that feeds water into the action area will not measurably increase flows, cause erosion, or increase suspended sediment or turbidity.

Magnitude – Measurable changes in peak and base flows caused by canopy manipulation (interception and evapotranspiration) are dependent on the extent of canopy that is altered. Similarly, changes in flow caused by soil compaction are also dependent on the extent of area compacted. No clearcut harvest has occurred since 1994 and these previously harvested lands are now in advanced stages of forest regeneration.

The project proposes to thin and yard from approximately 15.4 acres of the 9,962 acres that drain to the action area. The amount of canopy reduction in the harvest units averages less than 20 percent (range 5 to 27 percent). This small amount of canopy reduction is extremely unlikely to cause a measurable change in peak or base flows due to changes in precipitation interception or evapotranspiration. Yarding will occur on designated skid trails designed to keep detrimental soil compaction below 20 percent for each unit (including landings). This small amount of compaction is also extremely unlikely to cause a measurable affect to stream flows.

Element Summary – Thinning and yarding will occur on such a small proportion of the sub-watershed the project will have an *insignificant* and *discountable* effect on peak or base flows.

Fuels Treatment

Proximity – Fuels treatment will occur no closer than 40 feet from streams.

Probability – The effect that fuels treatment can have on peak and base flows is dependent on the extent, intensity, and arrangement of the burned area. Removal of vegetation and duff by fire can reduce infiltration and speed runoff. In addition, high intensity fires can create hydrophobic soils also reducing water infiltration. If the amount of area with increased runoff potential is great enough and is arranged in a continuous manner, changes in flow can occur.

Fuels treatment associated with the project is limited to burning small hand piles and piles on landings. The burning of piles creates a relatively high intensity fire that removes vegetation and duff, and also leads to the creation of hydrophobic soils. This leads to increased runoff from the area that the pile was located. The extent of burned area for each of these piles is small (8 X 8 feet), and they have a discontinuous distribution with approximately 20 feet between piles. Because of their discontinuous distribution and the flat nature of the units in which the piles were created, any runoff from the burned areas is likely to infiltrate into the unburned areas between the piles. In addition, the burned area constitutes less than 10 percent of the 15.4 acres of thinning.

Element Summary – Because of the small extent of the sub-watershed affected by fuels treatment, the discontinuous nature of the burned areas, and the ability of the vegetated areas surrounding the burned areas to allow for infiltration of water, it is extremely unlikely that any change in peak or base flows will occur.

Indicator Summary

PEs affecting this indicator are thinning, yarding, and fuels treatment. This action has the potential to impact peak and base flows in the short term but would be considered *insignificant* and *discountable* and thus not meaningfully measurable to the above indicators.

Direct and Indirect Effects – Drainage Network Increase

Thinning within the three units that are located on flat terrain and hauling logs on the existing paved road system has no mechanism to affect the drainage network.

Thinning, Yarding and Fuels Treatment

Proximity – There will be a 30 foot no-thinning buffer, and a 40 foot no-equipment buffer from all streams.

Probability – Ground-based skidding has the potential to remove duff and vegetation, create soil compaction and reduced infiltration of water. This can lead to increased surface runoff and channel formation especially in areas where the soil has been exposed. As noted in the discussion

on Suspended Sediment/Turbidity, the flat nature of the thinning units, use of designated skid trails (width and spacing), amount of expected ground disturbance, and presence of undisturbed vegetation remaining around the skid trails makes it is very unlikely that runoff will occur or that flow channels will be created.

Fuels treatment can remove vegetation and duff, baring the soil and making it vulnerable to rill and gully erosion. As discussed in the section on Suspended Sediment/Turbidity, fuels treatment will consist of pile burning on relatively flat ground with extensive intervening vegetation and duff between piles and between the piles and streams. The flat ground and remaining vegetation will make it highly unlikely that any rill or gully erosion will occur or that the drainage network will increase.

Indicator Summary

Because it is highly unlikely that any of the project elements will affect this indicator the project will have a ***discountable*** effect on this indicator.

Direct and Indirect Effects – Riparian Reserves

The three units that constitute the project were originally harvested between 1955 and 1967 (Table 3). After harvest the cleared land was replanted in a dense monoculture of Douglas fir. These dense conifer stocking levels are not natural in the wet riparian areas of the western hemlock/salmonberry plant association where, after a natural disturbance such as a stand replacement fire, initially comes back as brush. In these natural stands, the few trees that do break out above the brush grow in open conditions with little competition for light (Jane Kertis, Ecologist, Siuslaw National Forest, personal communication). These trees then grow rapidly adding diameter at a fast rate, having high live crown ratios, and large diameter live limbs relatively low on the bole of the tree (Poage and Tappeiner 2002).

Two of the three stands in the project area have been thinned previously to improve tree growth. The increase in the amount of light to the ground has allowed for shrub and some hardwood development. However, diameter growth of the conifers in these stands are beginning to slow.

Thinning will continue to keep the stand growing in more open conditions allowing the residual trees to develop a more natural growth form and for the stands to develop a more natural community and composition. This includes large limb development for marbled murrelet nesting, multi-story structure for northern spotted owls, and continued development of shrubs and forbs needed for amphibians (USDA Forest Service 2015).

Indicator Summary

Thinning of conifers would have a short-term *negative* impact, however *beneficial* over the long-term.

Direct and Indirect Effects - Refugia

Note: In the discussion that follows Refugia will be considered as a broad suite of habitats that provides for multiple life stages of the species. This is different than viewing refugia as a single habitat area, such as a cold spring, that provides a temporary refuge during the heat of the day. Individual habitat types are covered under many of the other indicators discussed in this document. Because coho salmon are anadromous the discussion of refugia will take into account just the suite of habitats for the fresh-water life stages of the fish.

Thinning has the potential to improve instream habitat conditions in a manner that could assist in the creation of a small refugia for coho salmon. Yarding, and fuels treatment have the ability to affect habitat characteristics but not to a great enough degree to significantly cause changes to this indicator (see discussions for other indicators).

Thinning and Yarding

Proximity – There will be a 30 foot no-thinning buffer, and a 40 foot no-equipment buffer from all streams.

Probability – Thinning is likely to accelerate the development of large trees that can then be recruited to the stream in areas of past habitat degradation (see other indicator analyses). Thinning will also reduce small wood recruitment and the corresponding cover it provides.

Magnitude – Restoration of habitat conditions by thinning can be significant (see analysis for Large Pools, Off-Channel Habitat, and Floodplain Connectivity) and can improve the primary missing elements (low-gradient winter habitat) of good refugia conditions. Thinning can also reduce the small wood inputs and some cover. The loss of small wood is limited to less than 10 percent along approximately .35 miles of coho CH present in the sub-watershed.

Element Summary –This project element has long-term beneficial effects to areas and habitat features that are important to a functioning refugia but also has some short-term, minor, negative effects to other habitat features.

Indicator Summary

The only project element affecting this indicator is thinning and therefore the indicator summary (the combined element summaries) is the same as the sole element summary. Overall, the project will have minimal, *negative* effects on some habitat features of refugia in the short-term and larger, *beneficial* effects on other habitat features of refugia in the long-term.

Direct and Indirect Effects - Road Density and Location

The project will not add, remove, or relocate any roads and therefore has no causal mechanisms to affect this indicator.

Indicator Summary

Because there will have no effect on road density or location the project will have a *neutra*l effect on this indicator

Direct and Indirect Effects - Disturbance History

Disturbance history is based on equivalent clearcut area (ECA). Thinning is the only project element with a causal mechanism to affect ECA.

Forest Service lands in the sub-watershed are predominantly forested with past timber harvest having occurred on approximately 35 percent of the forested lands with the remaining 65 percent having never been harvested. No clearcut harvest has occurred since 1994 and these previously harvested lands are now in advanced stages of forest regeneration.

We are unaware of any other projects in the action area that has reduced ECA. The project will have a *discountable* effect on disturbance history.

Indicator Summary

The project will have a *discountable* effect on this indicator.

Direct and Indirect Effects - Disturbance Regime

The disturbance regime is a set of natural processes that can add or diminish risk to fish populations. Thinning can increase the risk of a large, catastrophic fire starting by increasing the amount of fine fuels present in the three units. However, pile and burning can reduce this risk. Although large fires can be a dominant, natural component of the disturbance regime they also pose risk to fish populations and can be large enough to affect all the components within an entire refugia.

Characteristics of the thinning units that also reduce and increase the risk are; the flat, lowland nature of the terrain and the presence of the paved road. Fire starts will initially have a slow rate of spread due to the flat nature and humid conditions of the thinning units, allowing time for fire suppression. The presence of the road however increases chances of a fire starting due to increased human activity, however, can be used as a fuel break if a fire start occurs off the road. Fuels treatment endeavors to return the risk to pre-thinning levels by treating those fuels closest to human activity.

Fuels treatment will consist of piling and burning slash from the thinning operations within 100 feet of the county road and the North Fork Campground. Fine fuels generated by the thinning process pose a potential risk to the health of the riparian area. Treatment of the fuels next to the road and campground will reduce the probability of ignition of these fuels throughout the thinned area. Within three to five years the remaining fine fuels in the thinned riparian areas will

decompose to the point where they no longer pose a fire danger. Due to fuels treatment the risk of serious wildfire is maintained at low, pre-thinning levels.

Indicator Summary

Because fuels treatment returns the probability of a wildfire back to its pre-thinning level the project will have a *neutral* effect on this indicator.

Summary of Indicator Effects

The project will have short-term, insignificant effects on three indicators (temperature, suspended sediment/turbidity, and chemical contamination/nutrients); short-term, discountable effects on five indicators (width to depth ratio, streambank condition, change in peak/base flows, increase in drainage network, and disturbance history); and short-term negative effects to six indicators (large woody material, pool frequency, large pools, off-channel habitat, refugia, and floodplain connectivity). The project includes long-term beneficial effects to 10 indicators and long-term neutral effects to nine indicators.

Table 8 Short-term and long-term effects for the upper North Fork Siuslaw River Riparian Thinning Project.

	Baseline	Indicator Effects	
	Condition	Short-term	Long-term
Non-Watershed Indicators			
Temperature	NPF	Insignificant	Beneficial
Suspended Sediment/Turbidity	FAR	Insignificant	Neutral
Chemical Contamination/Nutrients	PF	Insignificant	Neutral
Physical Barriers	PF	Neutral	Neutral
Substrate Character/Embeddedness	FAR	Neutral	Beneficial
Large Woody Material	NPF	Negative	Beneficial
Pool Frequency and Quality	FAR	Negative	Beneficial
Large Pools	FAR	Negative	Beneficial
Off-Channel Habitat	FAR	Negative	Beneficial
Refugia	FAR	Negative	Beneficial
Wetted Width:Depth Ratio	FAR	Discountable	Beneficial
Streambank Condition	PF	Discountable	Neutral
Floodplain Connectivity	FAR	Negative	Beneficial
Change in Peak/Base Flows	-	Discountable	Neutral
Increase in Drainage Network	FAR	Discountable	Neutral
Watershed Condition Indicators			
Road Density and Location	NPF	Neutral	Neutral
Disturbance History	FAR	Discountable	Neutral
Riparian Reserves	FAR	Beneficial	Beneficial
Disturbance Regime	FAR	Neutral	Neutral

Summary

Direct and Indirect Effects to the Species

The project was designed to avoid all instream and streambank activities. However, negative effects to OC coho salmon could possibly be caused by thirteen of the habitat indicators (Table 8). Pool Frequency and Quality has minor, negative effects that are both short- and long-term but, as discussed below, this does not affect the limiting factor for coho salmon.

The effect on the Pool Frequency and Quality indicator is relatively small but still negative and could cause a seasonal reduction in coho parr. This is because the possibility exists that one or more trees removed from within 100 feet of the upper North Fork Siuslaw River could, if they had been left unthinned, died of suppression mortality and fallen into CH. The percentage of these trees that would actually create habitat for coho is probably very small due to the smaller than average size of tree that tends to die from suppression mortality, rot and vertical decomposition of dead trees without falling, and increased breakage rates due to rot if the dead tree should not fall immediately after death while still sound. Although these factors reduce the amount of suppressed and dead trees that would be recruited to the stream they do not completely eliminate dead tree recruitment.

Dead trees recruited to the stream through suppression mortality can create pool habitat and provide cover. Beechie and Sibley (1997) found that smaller wood, such as that produced through suppression mortality, can produce pools in alluvial substrates. In thier study wood was classified as pool-forming when it was stable and forced the flow in a direction consistent with the scour of the pool (Beechie and Sibley 1997). Although past splash damming and stream cleanout has greatly reduced the amount alluvial substrates present in the North Fork Siuslaw River, some gravel and finer sediments are present and smaller wood pieces could create some scour and associated low-flow pools. The removal of potential small wood recruitment through thinning is likely to reduce the potential for future low-flow pool habitat to some degree. Due to the amount of small wood reaching the stream, the amount of breakage of this wood due to rot, the small size of the wood relative to the size of the stream, and the scarcity of suitable alluvial substrate, the number of potential future pools that will not form due to thinning is expected to be few.

Reduced low-flow pool habitat will reduce the summer carrying capacity for juvenile coho salmon in the upper North Fork Siuslaw River. Some juvenile coho that could have utilized this habitat will instead perish due to increased competition, reduced growth, and displacement at the stream-reach scale (smaller, displaced fish are more susceptible to predation). However, because the limiting factor for coho is over-winter habitat, any loss of summer parr production is unlikely to carry over through the winter and affect spring smolt output. In the long-term larger pieces of

woody material produced by the thinning are likely to increase log jams and provide more winter habitat outside of main stream channels, boosting the freshwater productivity of this species.

Ten of the indicators have long-term, benifical effects to OC coho freshwater habitat. All of these long-term positive effects to coho habitat are dependent on creation large trees near the stream for recruitment at a later point in time. Eight of these indicators affect habitat elements related to over-wintering habitat. Improved over-wintering habitat will allow for increase survival of parr through the winter and increase smolt production in the spring.

Four of the ten indicators that were found to have long-term beneficial effects (Large pools, Off-Channel Habitat, Refugia, and Floodplain Connectivity) also have potential to have short-term negative effects to coho salmon. In all four instances these negative effects were related reduced potential for small wood and were found to be minor due to the amount of small wood recruitment from other sources.

Several of the indicators will also affect summer habitat conditions in the long-term, including substrate and temperature. Increased substrate depth can improve hyporheic exchange leading to reductions in temperature fluctuations and daily high temperatures. Through this process improved summer conditions would occur at about same time as improved winter conditions and some of the increase in summer parr production could be expected to carry-over into spring smolt production.

PBF - Forage

The project has the potential to increase the amount of available light that reaches the stream (see Temperature indicator discussion above). Any increase in light would increase primary production in the stream that could in turn increase aquatic invertebrate production. These aquatic invertebrates constitute the bulk of the juvenile coho salmon's diet in freshwater.

Mason (1976) found that food availability was the limiting factor for coho in streams during the summer, and that by increasing food availability with supplemental feeding the number of juveniles present at the end of summer could be increased. However, because it is unlikely that there will be any significant increases in sunlight to the stream, it is also unlikely there will be any increase in forage and juvenile coho numbers. In addition, even if there were an increase in juvenile coho numbers in the summer, there would not be an increase in spring smolt production as long as winter rearing habitat remains the limiting factor for smolt production.

Short-term vs. Long-term Risk

The project clearly has potential for some small, short-term, negative effects but has even greater potential for meaningful, positive, long-term, lasting effects. The long-term effects are considered meaningful because they address the limiting factor for coho production in the

Siuslaw Basin. Balancing short-term detriment to long-term benefit is a difficult decision and involves trade-offs.

In the long-term additional stressors will be applied to freshwater coho production due to climate change and additional human development activities caused by an ever increasing human population. Possible scenarios for climate change include increased stream temperature and an even more variable hydrograph. The long-term, beneficial effects of the project will add resiliency to the coho population from these future stressors by ameliorating the effects of increased stream temperatures with hyporheic exchange; dampening the variability of the hydrograph through floodplain re-connectivity; and providing much needed, additional off-channel habitats.

Given that the short-term potential negative effects are minor and the population is currently relatively healthy, the short-term risk to the population caused by the project appears to be low. On the other hand, because the project directly addresses limiting factors for smolt production and lessens the effect of future stressors, the long-term benefits of the project appear to be high. By reducing long-term risk the project is effectively preparing the OC coho salmon habitat in the upper North Fork Siuslaw River for the future.

ESA Effects Determination

The AP provides a dichotomous key which is utilized to reach the appropriate ESA effect determination. Utilizing the indicator summaries from Table 5 and the analysis of direct and indirect affects to it was determined that the proposed North Fork Siuslaw River Riparian Thinning Project is *likely to adversely affect* (LAA) Oregon Coast coho salmon individuals and designated critical habitat, as shown in Table 9.

Table 9 AP Project Effects Determination Key For Species and Critical Habitat

1) Do any of the indicators summaries have a positive or negative conclusion?	
X	Yes - Go to 2
	No – No Effect
2) Are the indicator summary results only positive?	
	Yes – NLAA
X	No – Go to 3
3) If any of the indicator summary results are negative, are the effects insignificant or discountable?	
	Yes – NLAA
X	No – LAA, fill out Adverse Effects Form

ESA Cumulative Effects

Cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02). Cumulative effects that reduce the ability of a listed species to meet its biological requirements may increase the likelihood that the proposed action will result in jeopardy to that listed species or in destruction or adverse modification of a designated critical habitat.

The most common activities reasonably certain to occur in the action areas addressed by this consultation are agricultural activities, urban development, recreational activities, logging, road construction and maintenance, and sport harvest. Many of these activities are not subject to ESA consultation and will result in some adverse effects to Oregon Coast (OC) coho salmon and their habitat. Some of the activities, such as logging and development, are subject to regulation under state of Oregon or other non-federal regulations, and the effects to OC coho and their habitat will be reduced to varying degrees under these regulations.

Sport harvest will probably continue to take returning adult coho. Since 1995 the harvest impact rate has ranged from two to eighteen percent of the returning adults within the ESU. In 2014 the harvest impact rate was fourteen percent and harvest impact amounted to 58,817 of the 420,122 adult coho making up the pre-harvest population. In 2015, Oregon Department of Fish and Wildlife creel surveys estimated the adult harvest for the Siuslaw River basin at around 1,100 adult fish (John Spangler, fisheries biologist, ODFW, personal communication). The number of smolts needed to produce these harvested fish varies based on ocean survival rates and could range from 11,000 smolts under good ocean conditions (ocean survival of 10 percent) to 110,000 smolts needed under poor conditions (ocean survival of one percent). Another way to view the impact of sport harvest is to consider it in terms of the number of eggs that were taken along with the adult fish. If half of the sport harvested fish were female and each carried 3,000 eggs then a total 1,650,000 eggs would have been harvested. The amount of these sport harvested fish and eggs destined to the upper North Fork Siuslaw River is unknown.

Throughout the range of OC coho, watershed councils, Native American tribes, municipalities, conservation groups, watershed councils, and others will continue to carry out restoration projects in support of salmon recovery. These actions include protection and/or restoration, or both, of existing or degraded fish habitat, instream flows, water quality, fish passage and access, and watershed or floodplain conditions that affect stream habitat. Some of these actions will lead to improvement in habitat conditions over time.

When considered together, these cumulative effects could have a somewhat large negative effect on the abundance, productivity, genetic legacy, and adaptive potential of OC coho. Similarly, the conditions of the critical habitat PBFs could be degraded by cumulative effects. However,

the Forest Service is not aware of any specific non-Federal actions planned within the action area that would cause greater effects to listed species or designated critical habitat than presently occur.

Essential Fish Habitat

The consultation requirement of section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions, or proposed actions that may adversely affect EFH. Adverse effects include the direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitats, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside EFH, and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) also requires NMFS to recommend measures that may be taken by the action agency to conserve EFH.

The Pacific Fishery Management Council (PFMC) designated EFH for groundfish (PFMC 2006), coastal pelagic species (PFMC 1998), and Pacific salmon (PFMC 1999). The action area includes areas designated as EFH for various life-history stages of Pacific salmon (Chinook and coho salmon). Estuarine and ocean habitat will not be affected by the proposed action. Therefore, there would be no effect to EFH of groundfish or coastal pelagic species.

Based on the analysis of effects presented in the ESA portion of this document, the proposed action will have both adverse and beneficial effects on Pacific salmon EFH, as follows:

- Potential for increased summer water temperatures at the stream reach scale for a period lasting from a few years to up to 20 years.
- Possible increase in invertebrate forage organisms lasting several months in reaches adjacent to the six proposed thinning units.
- A reduction in potential pools and cover from lost recruitment of small instream woody material for approximately 20 to 75 years in stream reaches that are adjacent to the six proposed thinning units.
- After a timeframe of 50 to75 years, the thinned riparian areas will begin to provide larger pieces of wood that form stable log jams and off-channel habitat, increasing cover; and trap and detain sediments that will aggrade stream channels, increase hyporheic exchange, causing the stream to cool.

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Appendix A: Maps

Appendix B: Documentation of Expected Adverse Effects to Listed Fish Species and their Habitat

Name of action: *North Fork Siuslaw River Riparian Thinning Project*
Species of concern: *Oregon Coast Coho Salmon*
HUC names and numbers in ESA action area: *upper North Fork Siuslaw (17 10 02 06 07 01)*

Identify critical habitat area of concern: *upper North Fork Siuslaw River*
Element(s) of the action causing the expected adverse effects: *Thinning*

1. The proposed action may result in adverse effects through which of the following mechanisms (underline or circle and describe in narrative).

Harass: significantly disrupt normal behavior patterns such as breeding, feeding, or sheltering.

Other forms of take: pursue, hunt, shoot, wound, trap, capture, kill, collect, or delayed mortality from stress or disease.

Habitat: cause an adverse effect to occupied or accessible habitat of listed species and designated critical habitat: P*ossible decrease in small wood in the short-term (20-30 years).*

2. Nature, magnitude and probability

Nature: *Temperature, Pool frequency and Quality*
Magnitude: *Temperature – insignificant; Pool Frequency and Quality – negative*
Probability: *Temperature - insignificant; Pool Frequency and Quality – negative short-term*

3. Which of the following life stages, forms and essential behaviors will be adversely affected (underline or circle and describe as appropriate)?

Life history forms

Resident
Fluvial
Adfluvial
Anadromous – *only one form present*

Life stages and essential behaviors

Fertilization to emergence
Emergence to juvenile out-migration (freshwater rearing) – *Summer rearing only, no effect on numbers out-migrating.*
Adult migration to spawning areas
Adult holding
Gamate survival and maturation
Spawning

4. Temporal Scale (frequency and duration) (underline or circle and describe as

appropriate).

a. Frequency: *Temperature – once; Pool Frequency and Quality - unknown*
b. Duration: *Temperature – beginning upon project implementation and lasting for 5-10 years; Pool Frequency and Quality – beginning 25 years from present and lasting for up to 50 years.*

5. **Spatial scale**

a. Distribution: *About .35 miles the North Fork Siuslaw River*
b. Proximity:
    i. Short-term: *Directly to coho habitat*
    ii. Long-term: *Directly to coho habitat*

6. Tracking Adverse Effects:

Catalogue a unit number for this adverse effect and identify the specific location on the GIS water theme as a point, segment, or polygon datum (depending upon the nature of the effect).

7. Include this form and map in the BA.

OK

Appendix C: Project Design Criteria and Best Management Practicies

The following project design criteria (PDCs) are project- and site-specific best management practices (BMPs) developed for the upper North Fork Siuslaw River Riparian Thin Project and are consistent with the USDA National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1: National Core BMP technical guide (USDA forest service 2012).

Criteria number	Objective	Design criteria for the project
Aquatics		
Aquatics-1	Reduce burn severity and soil impacts and preserve habitat in riparian areas	***Hand piles – Riparian Areas*** • No hand piling would occur within 40 feet from the stream channel • Hand piles should not exceed 60 piles per acre to keep pile area less than 5% of riparian area. Hand piles should be approximately 8 feet x 8 feet, and 20 feet apart. • Where possible, retain large wood that is at least 10 feet long and 12 inches or greater. • In units where these criteria are not possible, consult with an aquatic specialist.
Aquatics-2	Protect bank stability	***Conifer felling – Riparian Areas*** • There is a 30 foot no treatment buffer from any stream • Conifers will be felled away from the stream
Aquatics-3	Reduce soil impacts and prevent sediment delivery to streams	***Mechanized equipment – Ground based logging activities –Riparian Areas*** • There would be an equipment exclusion zone of 40 feet of any stream • There would be no skidding/yarding across stream channels • There would be no landings in riparian areas
Aquatics-4	Reduce potential for sediment delivery to streams	***Log haul - exemptions*** Roads exempt from hauling restrictions (due to no mechanism for sediment delivery) include paved roads, surfaced ridge top roads, surfaced outsloped roads with no ditch or stream crossings.
Aquatics-5	Reduce potential for chemical contaminants in waterbodies	***Fueling in Riparian Areas*** • No fueling of chainsaws would occur within 50 feet of stream channels. Any fueling that needs to occur within 50' would be confined with in a spill container (Ex. Volume pumps for drafting water). • Heavy equipment (yarder/skidder) and will be refueled at landings or service areas only; located at a minimum of 150 feet away from all stream channels. • Refueling drip torches will occur at landings or service areas, a minimum of 150 feet from streams.
Aquatics-6		***Thinning Treatments*** • Create average of 4 snags per acre • Fall and leave 2 trees per acre • No yarding will occur past October 15